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CONTENTS

MIDDLEKAUFF—Biology and ecology of several species of California rangeland grasshoppers 1
BECHTEL—Notes on emergence and a parasite of Megachile gentilis Cresson 12
MEDLER—Four new Scleroracus from the western United States 13
ALLRED—Mites found on mice of the genus Peromyscus in Utah. IV. Families Laelaptidae and Phytoseiidae 17
ESSIG—A Formosan aphid, Micromyzus formosanus Takahashi, on shallots in California 33
TIMBERLAKE—Temnosoma, a genus of bees new to the United States 34
RYCKMAN & LEE—Recent collections of Mallophaga and Anoplura from southern California 35
MACSWAIN—Longevity of some anthophorid bee larvae 40
CHEMSAK—Rearing records for some California Cerambycidae 41
CHEMSAK—An attractant for two species of Cerambycidae 42
DUNCAN—A new subspecies of the genus Cicindela 43
NIELSON—An early record of the Khapra beetle in Arizona 44
USINGER—Harzwanzen or "Resin Bugs" in Thailand 52
INSECT PHOTO SALON 16
ZOOLOGICAL NOMENCLATURE 11
PROCEEDINGS, Pacific Coast Entomological Society 45

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BIOLOGY AND ECOLOGY OF SEVERAL SPECIES OF CALIFORNIA RANGELAND GRASSHOPPERS

(Orthoptera: Acrididae)

WOODROW W. MIDDLEKAUFF[1]
University of California, Berkeley

Studies of the biology and ecology of rangeland grasshoppers have been badly neglected. Much of this neglect can be attributed to the large areas of grasslands involved and, during the era of control by scattering poison baits, the expense and difficulty of control. Westerners have long been aware that grasshoppers on our rangelands have caused economic loss. Like grasshoppers on croplands, those on the range do damage that goes beyond the actual loss of forage. They cut stems and blades, eating only a part of them; they prevent reseeding; they eat grass closer than livestock, and when extremely abundant may injure the crown of the plant so that subsequent growth is retarded; the soil is exposed to the eroding effects of wind and water and they even annoy livestock by jumping in their faces when the latter try to feed.

It was not until the advent of some of the newer insecticides such as aldrin that we realized just how damaging to the range the grasshoppers could be. Workers in the U.S.D.A. have estimated that when grasshopper populations average 6 to 7 per square yard, which I may say is a light infestation, those on 10 acres can eat as much grass as one cow. Many of our infestations in California this past summer were 5 to 10 times this heavy.

As a consequence of the growing awareness of the need for fundamental studies a cooperative regional project was set up with workers in Idaho, Montana, Colorado, Wyoming and California participating. A small sum was allocated to California last August permitting us to begin active participation.

Our objectives were three fold: (1) to make an intensive ecological study of a limited rangeland area inhabited by several of the important rangeland grasshoppers, (2) on the basis of this ecological study, to analyze and evaluate the roles of the various

[1] Presidential address, presented to the Pacific Coast Entomological Society on the occasion of its annual December meeting.

ecological factors (natural enemies, weather, microclimates, vegetation, soil, etc.) in the population dynamics of rangeland grasshoppers in this limited area, (3) to use this information in helping to better understand population dynamics of range grasshoppers, to predict grasshopper damage to rangelands, and to develop more effective and intelligent control measures.

Study areas were selected at the Hopland Range Experiment Station; a foothill area north of Oroville; and a foothill area in the Patterson Pass area of the Livermore hills.

These areas were visited at frequent intervals this past season, field studies and collections were made and this address today is based in part upon these studies.

Much information on species, sex, age composition, parasitism, etc. remain to be secured from the specimens still preserved in alcohol.

A check list of grasshopper species based on a list made by Dr. H. F. Strohecker shows that there are some 187 species in 58 genera occurring in California. At least 50 per cent of these could be classified as rangeland species, those species which normally feed on grasslands and seldom, unless in outbreaks, invade cultivated areas.

In any given area of rangeland it is normal to have a number of different species in close competition with one another. Cropland species, on the other hand, are only infrequently found competing with several other species.

In all three study areas eight or more species could be found, but the following four were predominant: *Melanoplus devastator*, the devastating grasshopper; *Camnula pellucida*, the clearwinged grasshopper; *Oedaleonotus enigma*, the valley grasshopper and *Dissosteira spurcata*, which has no common name. The following remarks are based upon these four species.

Melanoplus devastator is our most widespread rangeland species and except for localized populations of other species is also most abundant. It is found on the semiarid rangelands in California from Siskiyou county in the north to San Diego county in the south, at elevations from near sea level to over 5,000 feet. It is especially abundant in the oak-grassland plant associations of the Upper and Lower Sonoran life zones where clovers, filaree and annual grasses are dominant.

Outside of California it is recorded from Arizona, Nevada, Utah, Oregon and Washington.

In its nymphal stages this species inhabits much of the range and feeds on the legumes, filaree, bromes and hordeums as long as they remain succulent. When these plants become mature in late May and June the grasshoppers leave the higher parts of the range and congregate in great numbers in swales along roadsides or areas where drought resistant plants such as tarweed, *Hemizonia virgata*; buckthorn weed, *Amsinckia douglasiana*; bluecurls, *Trichostema lanceolatum*; milkthistle, *Silybum marianum;* wild buckwheat, *Eriogonum* spp. and yellow star thistle, *Centaurea solstitialis* can be found. Although they may only feed sparingly upon these latter plants they find them useful as roosting places on which to escape from the high soil-surface temperatures, which often reach or exceed 130°F during the summer.

The nymphs of the devastating grasshopper usually migrate downhill toward more succulent green vegetation, following ravines and lower land toward cultivated crops, often migrating five miles or more during this stage. Heavy movements of nymphs and some adults were taking place this past year by June 13 in the Oroville and Livermore areas as well as in other areas of the state. Grass was dry and shedding seed on hillsides at this date but swales were still green.

The direction of movement is determined by the slope of the land and not by wind direction. Hoppers move downhill with or against prevailing winds as shown by numerous observations made in the study areas. This results in heavy concentrations at the foot of the hills and canyon bottoms.

By the second week in July the species has largely reached the adult stage. The adults are strong fliers and may migrate in thick swarms fifteen or more miles in a single day. Adult movements are less predictable and may be delayed until quite late in the season. For example between July 25 and August 8 a spectacular movement of adult *M. devastator* from the Hopland study area took place. On the latter date it was difficult to collect several dozen adult specimens in an area where they had been extremely numerous less than two weeks previously.

This species is reported by Wilson (1947) to fail to reproduce outside the normal habitat. A residual population, however, remains in the foothills and constitutes the breeding population. A survey in late November in the Livermore hills revealed no *M. devastator* in low areas. Not until we checked halfway up the

Patterson Pass road at an elevation of about 800 feet did we start to encounter *devastator*. Adults were more common on the warmer south and east slopes near the ridge tops.

Dissections have shown that, unlike many of our other economic species that begin to oviposit within ten days after reaching the adult stage, *M. devastator* has a preoviposition period ranging from three to five and a half months, during which no ovarian development or copulation takes place. The breaking of this arrested development apparently is dependent upon the onset of the first fall rains with the concomitant appearance of green grass.

During a five-year period (1951–1956) weather data from Hopland has shown that the earliest date for the first fall rain of 0.5 inch was August 25 and the latest was November 13. Thus oviposition of *devastator* does not usually begin before September, and under conditions of prolonged delay of fall rains may not start until mid-November or even later. Eggs of this species were found in the Oroville area on October 5, 1956 at which time new grass was 1½ inches in height following 0.85 inch of rain. The eggs were on a south facing slope about three inches from the base of a small rock. Fifteen additional areas were examined but no more pods could be found at this date. A survey on November 24, 1957 in the Livermore hills failed to reveal egg pods of this species, however, many were found December 30 in the hills behind Mission San Jose, California.

The egg pods are not laid at random, but are deposited in restricted locations on well-drained hillocks, ridges, banks of ravines and slopes protected from prevailing winds where soil is gravelly or poor. Within these areas a relatively small area may contain many egg pods, with only a few in the surrounding soil.

Many pods are deposited in association with the basal growth of such plants as Russian thistle, milkweed, mustard, tarweeds and others. Some are laid in the soil at the edge or even under rocks if a crevice is present. Still others are laid in the matted roots of filaree or in small, well-drained bare spots.

The eggs begin hatching approximately ten days later in the spring than do those of most other economic species in the same area. This is probably due to the lateness in time of oviposition and in total cumulative heat units following oviposition. The minimum effective temperature for egg development of related species is approximately 60°F.

The hatching period, lasting from late April to late July, ranges from 50–103 days, and is thus much longer than that of other economic species in the same area. In most years it is at least twice as long as that of *Camnula pellucida* or *Oedaleonotus enigma*. Many nymphs of *M. devastator* may still be present when associated species are at their peak of oviposition.

The longevity of adults varies markedly and is dependent on climatic conditions. Winters having relatively high temperatures, with sufficient moisture to produce ample food, increase the length of life. Adults have been reported as late as mid-February. The late season adults become very dark, almost lead colored.

Camnula pellucida occurs very abundantly in California and in many localized areas, especially where grasses are more luxuriant, may outnumber *M. devastator*. This species is found in grasslands of mountain meadows, foothills and valleys throughout cismontane California to elevations exceeding 7,000 feet. Outside our boundaries it is found in the northern tier of states into adjacent Canada and in all the states lying west of the 100th meridian. It is primarily a grass feeder but when in outbreak numbers is very destructive to other types of vegetation such as small grains.

Oviposition usually begins the latter part of July and continues through August. Adults were found copulating July 17 at Oroville this past season. This species differs from other California grasshoppers in that it has definite oviposition areas and according to Wilson (1936) goes back and forth between 10 a.m. and 3 p.m. between these areas and the feeding grounds. These oviposition sites are usually on uncultivated grassy knolls and are small in area and well defined. Those studied by Wilson at Tulelake varied from 2 to 20 acres in size. Males attend the ovipositing females and may greatly outnumber the females.

The eggs hatch from early May to the latter part of June.

C. pellucida is migratory in habit both in the immature as well as the adult stages. In some areas it is called the warrior grasshopper because the nymphs march in bands from one field to another.

Oedaleonotus enigma ranges throughout the Pacific Coast, having been reported from California, Oregon, Washington, Idaho, Nevada and Arizona. Its distribution in California is similar to that of *M. devastator* though populations have been more localized.

It reaches its greatest abundance along the eastern foothills of the Coast Ranges.

O. enigma is typically a grassland-foothill species. Eggs are laid from July to October. Hatching occurs in early April usually two to three weeks earlier than *devastator*. Egg laying habitats include rolling foothills, valley slopes and uncultivated gravelly flat land with sparse vegetation. Favored egg-laying spots include around and under rocks, under cover of turkey mullein or adjacent to the basal growth of such weeds as thistles, milkweed, poverty weed and saltbush.

Numerous characteristic egg pods were found in the Oroville area during a survey in early October. Small hummocks only several feet above the general ground level were favored and here between or beside small stones, and especially beneath turkey mullein, oviposition took place.

Only the brachypterous adults have been encountered in the Livermore, Oroville and Hopland areas. The long winged form has been reported from other areas in California.

Dissosteira spurcata occurs in the rangeland areas of California from Tehama County in the north to San Diego in the south and was present in fair numbers at all three study areas. It is also reported from Utah and Nevada. Little is known about its biology so the following observations will be of interest.

Beginning in early July the males of this species engage in mating flights. A single male can be seen to jump into the air a foot or two above a patch of flattened grass or bare spot. The flight is noiseless for about 5–8 seconds then with a slower wing-beat and the abdomen pointed almost downward he begins to make a characteristic buzzing song which lasts about 20 seconds but may continue for 35. The male then abruptly drops to the ground and makes three or four raspng noises by sharply raising the hind legs and rubbing them against the tegmina. A female or two is usually on the ground beneath the singing male. Males were readily collected by approaching with 15 to 20 feet while they were engaged in the nuptial flight and then scooping them up with an insect net in a quick dash. Mating was not observed.

This past season witnessed one of the heaviest rangeland grasshopper outbreaks since the spectacular one in 1949. Grasshoppers were extremely abundant in the ranges around the Central Valley and caused considerable damage. *Melanoplus devastator* was the

predominant species. It was necessary to treat thousands of acres of rangeland to prevent serious damage to adjacent croplands.

The severity of the grasshopper outbreak can be explained to a certain extent by climatological data for 1956–57. At Hopland, 3.03 inches of rain fell in October and permitted females of *M. devastator* to oviposit over a long period of warm, relatively dry weather in November and December with a total precipitation of less than one inch during the latter two months. Moderate rains totaling 29.4 inches fell during the rainy season permitting good grass growth. Maximum daily temperatures remained below 60°F until the latter part of March. Moderate rains during March, April and May with relatively cool weather held back the egg hatch. During the late May early June hatching period no rain fell to harm the nymphs or permit a disease outbreak.

During the heavy movement out of the Livermore hills the country took on a desolate appearance due to defoliation of many trees, shrubs and grasses. The following is a list of some of the plants heavily fed upon: apricot, fig, privet, *Genista*, *Pyracantha*, *Cydonia*, *Cotoneaster*, cottonwood, *Buddleia*, Persian walnut, *Baccharis*, elderberry, pepper, poison oak, willow, gum weed, mullein, grape, juniper and most of the legumes and grasses. Perhaps the most notable were the few plants not attacked such as *Robinia*, toyon, *Acacia*, Lombardy poplar and elm. These were only lightly fed upon.

Temperature plays an important role in regulating many activities of grasshoppers. A number of observations were made this past season and more extensive ones with the aid of our new mobile laboratory are planned for the future.

Hoppers are quite sluggish when the ground temperature is around 60°F. and can easily be picked up by hand. If they do jump at this temperature they seem unable to do so a second time and can then be captured. Above 70°F. they become quite active and can only be caught then with the aid of a net.

During the heat of the day when ground temperatures in full sun exceeded 110°F. the grasshoppers concentrate in the more grassy areas and around clumps of taller vegetation, such as Harding grass clumps. As temperatures continue to rise the grasshoppers discontinue activity and seek shady spots or climb up grass or weed stems and remain there until late afternoon. Temperature readings taken at Hopland on 24 July showed the

ground temperature to be 131°F. at 2:30 p.m. At this time few hoppers could be found on the ground. Most of them were clinging to grass stems several inches to one foot above ground. Air temperatures taken at the same time as the ground temperatures, showed it to be 29 degrees cooler one foot above the ground. Similar readings beneath the shade of an adjacent oak, where hoppers were numerous showed a ground temperature of 91°F. and only one degree cooler one foot above ground. No hoppers were clinging to vegetation beneath the oak at these temperatures.

After nightfall the ground temperatures are usually warmer than air temperatures, for example at 9:30 p.m. on 24th of July at Hopland the ground temperature was 76°F. while the air temperature was four degrees cooler. As the night progressed the hoppers gradually descended the grass stems and by the following dawn had burrowed into the grass clumps. The ground temperature at 7:15 a.m. was 57°F. while the air temperature was 56. No activity took place at these temperatures.

The commonly accepted technique for determining adult populaitons by estimating the number of individuals on a number of estimated square foot samples, leaves much to be desired. Adults tend to fly, in many instances while beyond the range of human visual acuity. There is a moving wave of adults preceding the counter. In addition the eye tends to be attracted to a moving object and thus there is a tendency to pick out those square foot areas where hoppers are present and moving and avoiding the areas where none are present. All of these factors tend to give an incorrect estimate of the population.

Several of these difficulties can be overcome by counting adults at night. A wire screened wooden frame, one foot square was constructed. Several nails projecting from the bottom edge prevented it from skidding or rocking. After darkness had fallen and the hoppers had ceased activity the frame was thrown at random in an area where hoppers had been most numerous during the day. Atomized lighter fluid or an aerosol insecticide was then used to agitate the hoppers enclosed beneath the wire mesh which were then counted with the aid of a flashlight. In several areas where these counts were made the cage sample showed far fewer adults than were estimated during the day.

Grasshoppers have many natural enemies. Without the effects of parasites, predators, diseases and adverse climatic factors,

grasshoppers would be much more abundant and outbreaks would be more frequent and severe. Some affect the eggs while others affect the immature and adult stages. Among the more effective enemies in California are Bombyliidae, Meloidae, Sarcophagidae, spiders, rodents and other mammals, birds and diseases. Parker and Wakeland (1957) report that rangeland species suffer far less from egg pod predators than do those species in croplands. The fact that most species of rangeland grasshoppers scatter their egg pods more widely than species of crop grasshoppers, makes it more difficult for predators to find them and may be one reason for the lower percentage of egg pods destroyed in grasslands. The above authors also found predatism to be always highest during those years of greatest egg pod numbers. Another possible explanation of the higher predatism in cropped areas is the fact that Bombyliidae adults frequently gather in large numbers to feed on the blooms of annual plants growing on disturbed ground along fence rows and roadsides and numerous Meloids feed on legumes such as alfalfa, *Melilotus* and composits such as *Hemizonia*.

Wilson (1936) studying *Camnula pellucida* in the Tulelake area of California in 1928 found a Bombyliid, *Aphoebantus hirsutus*, to attack up to 62 per cent of the egg pods of this grasshopper and in spots to completely eliminate the threat of an outbreak. I have found, as yet unidentified, Bombyliidae larvae on the egg pods of *O. enigma* at Oroville, but only in very small numbers.

According to MacSwain (1956) the known life cycles of the meloid subfamily Lyttinae, which includes *Epicauta*, indicate that females lay eggs in excavations in the soil. However, observations made in the Oroville area would indicate that this habit does not hold true for all members of the genus. A number of adult meloids were collected feeding upon the flowers of *Hemizonia*, a tarweed. These were identified by Werner as mostly *Epicauta puncticollis* with several *E. californica* also present. These are very common and widespread species in California. According to MacSwain nothing is known about the life cycle of *puncticollis*. Parker and Wakeland (1957) list it as the only meloid egg pod predator known in California. The area where these meloids were found was heavily infested with *M. devastator*. On October 4, 1956 numerous meloid eggs were found on the under surface of a rock

and on the soil beneath. The rock was not resting flat on the ground but was somewhat concave permitting adult beetles to crawl beneath and oviposit.

At least 13 distinct egg masses were found with one mass containing 150 eggs. A total of about 1,500 eggs were present in all stages of development. Some triungulin larvae were hatching at this date and were running rapidly over the surface of the rock. They continued to hatch until October 25th when approximately 1,000 larvae had been collected and preserved in alcohol. Dr. MacSwain identified the larvae as mostly *E. puncticollis* with some *E. californica* present. Dr. Hurd collected eggs of *E. californica* in the Patterson Pass area of Alameda county in November, 1948 and larvae emerged 26 days later. Thus the incubation period is between 21 and 26 days, with the larvae overwintering.

On July 25, 1957, at Hopland in an area of sparse vegetation with sandy soil, a female *Tachysphex tarsatus* Say (det. R. M. Bohart) was observed to attack and subdue a second instar nymph of an oedipodine grasshopper. She pounced upon the nymph which was nearly her size, clinging tenaciously to it while they both struggled on the ground. The grasshopper fighting for its life, the female *Tachysphex* for food for her future offspring. The wasp quickly stung the nymph under the thorax and the hopper immediately gave up the struggle. She paused briefly, placed herself astride the victim, grasped its head with her mouthparts and the abdomen with her hind legs and proceeded to drag the victim over the ground in short flying hops. She was captured during her journey.

Williams (1913) made some careful observations on this species in Kansas and reported that the nest is made in sandy soil, about one and one-half inches long, terminating not quite an inch below the surface of the ground. The tunnel, which is dug before the hunt begins, is left open while the female is sarching for young grasshoppers. It is of comparatively large bore, slightly inclined, and not more than two inches long. As a rule a single nymphal grasshopper suffices for one wasp larva. Williams reported never having seen a nest with more than two hoppers per nest. The female lays an egg on the ventral part of the hopper's thorax and then closes the burrow with the loose soil at the entrance. She then leaves, presumably to repeat the process again and again.

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ZOOLOGICAL NOMENCLATURE: NOTICE OF PROPOSED USE OF THE PLENARY POWERS IN CERTAIN CASES FOR THE AVOIDANCE OF CONFUSION AND THE VALIDATION OF CURRENT NOMENCLATORIAL PRACTICE. (A(N.S.)40)

Notice is hereby given that the possible use by the International Commission on Zoological Nomenclature of its Plenary Powers is involved in applications relating to the under-mentioned names included in Double Part 10/11 of Volume 13 and Part 1 of Volume 16 of the *Bulletin of Zoological Nomenclature* which will be published on 30th December, 1957.

(a) *Application in Part 1 of Volume 16*

(1) *Calandra (Calendra)* Clairville & Schellenberg, 1798, suppression of, in favor of *Sphenophorus* and *Sitophilus*, both Schoenherr, 1838, respectively, in interests of universality of nomenclature; *abbreviatus* Fabricius, 1787 *(Curculio)* and *oryzae*, emendation to, of *oryza* Linnaeus, 1783 *(Curculio)*, validation of (Class Insecta, Order Coleoptera) (Z.N.(S.)255).

The present Notice is given in pursuance of the decisions taken on the recommendation of the International Commission on Zoological Nomenclature, by the Thirteenth International Congress of Zoology, Paris, July 1948 (see *Bull. Zool. Nomencl.* 4:51–56, 57–59; *ibid.* 5:5–13, 131).

Any specialist who may desire to comment on any of the

foregoing applications is invited to do so in writing to the Secretary to the International Commission (Address: 28 Park Village East, Regent's Park, London N.W. 1, England) as soon as possible. Every such comment should be clearly marked with the Commission's File Number as given in the present Notice, and sent *in duplicate*.—FRANCIS HEMMING, *Secretary to the International Commission on Zoological Nomenclature.*

NOTES ON EMERGENCE AND A PARASITE OF MEGACHILE GENTILIS CRESSON

(Hymenoptera: Megachilidae)

ROBERT C. BECHTEL
University of California, Davis

Several nests of *Megachile (Litomegachile) gentilis* Cresson were collected from the stems of blue elderberry, *Sambucus coerulea* Rafinesque, at Davis, California, in January of 1954 and 1955, by the writer. The nests were placed in cages near the collection site, thus allowing the specimens to emerge under field conditions.

Five male specimens of *M. gentilis* emerged from five cells of an eight cell series on May 8 to May 11, 1954. Three male specimens of *Coelioxys novomexicana* Cockerell were reared from three of these cells on May 4 to May 6, 1954.

In 1955, four different cell series were obtained. Seven male specimens of *M. gentilis* emerged from two of these series on May 10 to May 15, while eleven female specimens emerged from all four series on May 10 to May 16, 1955. Two specimens, one male and one female, of *C. novomexicana* were reared from two of the cell series. The male emerged May 5 and the female May 7, 1955.

Michener[1] listed no host of *C. novomexicana*. Therefore, this host-parasite relationship constitutes the first known record of a host, *M. gentilis*, of *C. novomexicana*. I am indebted to T. B. Mitchell for identification of the bees.

[1] Michener, C. D., 1951. Family Megachilidae. In Muesebeck, C. F. W., et al., Hymenoptera of America north of Mexico, synoptic catalog. U. S. Dept. Agr., Agr. Monog. no. 2, pp. 1136-1186. (p. 1185).

FOUR NEW SCLERORACUS FROM THE WESTERN UNITED STATES

(Homoptera: Cicadellidae)

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University of Wisconsin, Madison

The determination of certain species in the genus *Scleroracus* Van Duzee (= *Ophiola auctt.*) is difficult, and particularly troublesome are forms previously known as *striatulus* Fallén. A study of the internal male genitalia has shown that *striatulus* Fallén is European, and that several undescribed species are represented in North America. The complex was previously restricted by Ball (1928, Bul. Brooklyn Ent. Soc., 23:190) who described *osborni*, and Oman (1947, Iowa State Jour. Sci., 21:206) who illustrated the internal male genitalia of *vaccinii* Van Duzee. Three of the new species described at this time are in the *striatulus auctt.* complex and have distribution in western North America.

Scleroracus balli Medler, new species

Similar to *osborni* (Ball) in size, shape of the crown, and broad appearance; but much darker in color, with different leg markings and distinctive internal male genitalia. Length: male 4.0 mm., female 4.5 mm. Width of head across the eyes: male 1.3 mm., female 1.5 mm. Crown obtusely angular, one and one-third longer at middle than against the eye, about half as long as the pronotum.

Color: Dark brown in general appearance. Crown, pronotum and scutellum with very dark brown markings, somewhat diffused on pronotum except on anterior margin. Crown with well-defined transverse bands, the bands between eyes connected at middle. Forewing subhyaline, veins broadly margined with fuscous, inner apical cells entirely dusky, outer apical cell not entirely darkened. First cross vein appearing to be broadly white because of fuscous edging. Legs testaceous, heavily marked with brown-black, the fore and middle femora with light bands near middle and at apex, tibiae dark; hind femora dark basally, testaceous apically, except for a narrow dark band just at apex. *Genitalia:* Aedeagus as illustrated in figure 1, the spine on shoulder resembling that of *corniculus* (Marshall). Female sternite VII slightly emarginate at middle, lateral margins angled, broadly darkened with fuscous on the posterior margin.

Holotype male and allotype female: ESTES PARK, COLORADO, July 18, 1935 (Oman). Paratypes: 6♂♂, 5♀♀, Estes Park, Colo., July 18, 1935 (Oman); 1♂, 2♀♀, Pingree Park, Colo., August 22, 1931 (R. H. Beamer); 1♂, 1♀, Anaconda, Mont., August

12, 1931 (R. H. Beamer); 1♂, 2♀♀, Walden, Colo., August 20, 1931 (R. H. Beamer).

Holotype, allotype, and paratypes in the United States National Museum. paratypes in the Kansas University Museum.

This species has been described from the dark forms, but the color is variable. Pale specimens have the lines on the crown faded, infuscation of the forewing reduced, and markings on the legs lost. The band posterior to the ocelli usually remains distinct.

The distribution of *balli* is predominantly at higher elevations of the Rocky Mountain Region. In addition to the types one hundred and twenty-five specimens in the Kansas University collection have been examined from Colorado (Sloss. Walden. Muddy Pass, Pingree Park), Montana (Anaconda) and Manitoba (Red Deer River, Mafeking, Swan River, Deepdale). The species is named in memory of E. D. Ball.

Scleroracus myralis Medler, new species

Resembles *osborni* (Ball) in size, and shape of crown, but without the distinctive leg markings of that species. Length: male 4.0 mm., female 4.6 mm. Width of head across the eyes: male 1.2 mm., female 1.6 mm. Crown obtusely angular, slightly longer at middle than against the eye, two-thirds as long as the pronotum.

Color: Light tan or ochreous in general appearance. Crown with brown transverse markings faded, but the typical pattern distinguishable, band posterior to ocelli distinct. Pronotum and scutellum without distinct brown markings. Forewing with varnished texture, hyaline, the veins distinct, narrowly edged with fuscous. Legs light tan, devoid of brown markings. *Genitalia:* Aedeagus as illustrated in Figure 2. Female sternite VIII very slightly produced at middle, sharply angled at sides.

Holotype male and allotype female: SNYDERVILLE, UTAH, July 16, 1935 (Oman). Paratypes: 2♂♂, 1♀♀, Colo. 2009, 1♂ Colo. 2158, 2♂♂, Colo. 1581; 1♀, Snyderville, Utah; 1♀, Altus. Utah, 30 July, 1911; 1♀, 1♂, Yellowstone Park, Wyo., July 20–25, 1920 (AAN).

Holotype, allotype, and paratypes in the United States National Museum. Paratypes in the Minnesota University Museum.

The type is light in color and had faded markings, but the species has darker forms with distinct dark-brown markings on the crown, thorax and scutellum.

In the dark forms the anterior and middle femora are banded with dark brown at base and before the apex but the posterior femora remain ochreous. The uniformly narrow fuscous edging

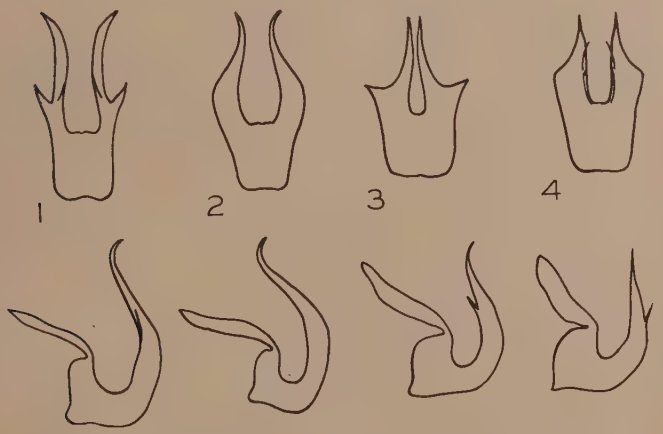
of the wing veins gives this species a somewhat distinctive appearance in either the pale or dark form.

Scleroracus taramus Medler, new species

Similar to *osborni* (Ball) in the obtusely angled shape of the crown, but with different leg markings, a more contrasting pattern of the forewing, and distinctive internal male genitalia. Length: male 4.5 mm., female 5.0 mm. Width of head across the eyes: male 1.3 mm., female 1.5 mm.

Color: Crown, pronotum and scutellum with distinct fuscous spots and lines, the transverse markings on the crown in characteristic pattern, the posterior and middle bands connected to each other at center and near eyes. Forewing whitish subhyaline, cells and veins outlined distinctly with fuscous, inner apical cell smoky. Fore and middle femora twice-banded with fuscous, hind femora unicolorous tawny. *Genitalia:* Aedeagus as illustrated in Figure 3. Female sternite VII slightly sinuate on posterior margin, the lateral angles acute; the posterior margin marked with brown.

Holotype male and allotype female: RICHFIELD, UTAH, July 15, 1930 (light trap). Paratypes: 1 ♀, Richfield, Utah, July 15, 1930 (light trap); 1 ♀, Ft. Collins, Colo., July 19, 1936 (Oman); 1 ♂, Little Beaver Cr., Colo., July 11, 1937 (R. H. Beamer); 1 ♀, Dolores, Colo., August 2, 1900; 1 ♀, Salida, Colo., July 24, 1900; 1 ♂, 1 ♀, Macedonia, Colo., July 1, 1931 (R. H. Beamer); 1 ♂, 1 ♀, Jemez Springs, N.M., July 15, 1919.



EXPLANATION OF FIGURES

Caudal and lateral views of aedeagus: Fig. 1, *Scleroracus balli;* Fig. 2, *S. myralis;* Fig. 3, *S. taramus;* Fig. 4, *S. beameri.*

Holotype, allotype, and paratypes in the United States National Museum, paratypes in the Kansas University Museum and DeLong collection.

Scleroracus beameri Medler, new species

Resembling *shastus* (Ball) in the angled shape of the crown; but darker, and with distinctive internal male genitalia. Length: male 4.2 mm., female 4.8 mm. Width of head across the eyes: male 1.3 mm., female 1.5 mm.

Color: Species dark brown in general appearance. Crown, pronotum and scutellum ochreous. Crown distinctly marked with black or dark-brown transverse lines in the pattern characteristic of the genus. Ocelli red. Pronotum with extensive irregular dark markings, anterior margin not marked at middle. Scutellum darkly marked at lateral and posterior angles. Forewing whitish subhyaline, veins distincly whitish, outlined by dark brown, first cross vein and apices of claval veins at commissure broadly white. Fore and mid-femora twice-banded with fuscous, hind femora infuscated. *Genitalia:* Aedeagus as illustrated in Figure 4. Female sternite VII broadly excavated, lateral angles acute, middle part of entire segment dark brown, posterior margin more widely brown.

Holotype male and allotype female: HECITA, OREGON, July 11, 1935 (R. H. Beamer). Paratypes: 17♂♂, 7♀♀, Hecita, Oregon, July 11, 1935 (R. H. Beamer); 2♀♀, Florence, Oregon, July 11, 1935 (R. H. Beamer); 1♀, Rochester, Washington, July 22, 1931 (R. H. Beamer); 1♀, Ft. Lewis, Washington, July 5, 1935 (Oman).

Holotype, allotype, and paratypes in the Kansas University collection, paratypes in the United States National Museum.

I take pleasure in dedicating this species to R. H. Beamer, who for many years was curator of the Snow Collection at Kansas University, and was an indefatigable collector of leafhoppers.

INSECT PHOTO SALON

At its annual meeting on June 25–27, 1958, the Pacific Branch of the Entomological Society of America will hold its third annual Insect Photo Salon at the El Cortez Hotel in San Diego, Calif. All persons, professional or amateur, are invited to submit photographs of insects, spiders, and related arthropods for exhibit at this Salon. All requests for entry blanks and information as to entries should be addressed to: DR. LELAND R. BROWN, *Co-chairman, Insect Photo Salon Committee, Department of Entomology, University of California, 300 Veteran Avenue, Los Angeles 24, Calif.*

MITES FOUND ON MICE OF THE GENUS PEROMYSCUS IN UTAH. IV. FAMILIES LAELAPTIDAE AND PHYTOSEIIDAE[1]

(Acarina)

DORALD M. ALLRED
Brigham Young University

In three previous papers (Allred, 1956a, 1956b, and unpublished manuscript), the author discussed the general mite infestation of five species of white-footed mice in Utah, *Peromyscus boylii*, *P. crinitus*, *P. eremicus*, *P. maniculatus*, and *P. truei*, and the species of mites of the families Haemogamasidae and Dermanyssidae found on these mice over a five-year period. This paper is a continuation of the results of that study.

LAELAPTIDAE

EUBRACHYLAELAPS CIRCULARIS (Ewing), 1933

(Plate II, Figs. 36, 40, 41, 45, 47, 49; Plate VI)

Ewing (1933) described *E. circularis* from two females taken from two specimens of *Peromyscus truei* collected at Salina, Sevier County, Utah, by J. S. Stanford in November and December, 1928. When compared with Ewing's description of the type and with notes by Jameson (1950, 1951), mites that were collected recently in Utah differ very little.

This species occurs frequently on mice of several species of *Peromyscus*. Jameson (1950) listed *P. truei*, *P. boylii*, and *P. hylocetes* as known hosts. In addition to the type locality of this species in Utah, Keegan (1953) has record of one female taken from *P. truei*. These mites probably are state-wide in distribution. They are known to occur in Utah at elevations from about 2250 to 6250 feet in all of the life zones from the Lower Sonoran to the Canadian. They were collected most frequently in the Upper Sonoran and Transition life zones.

A total of 392 female mites of this species was taken from 71 mice. The mites were collected every month, although those in the southern part of Utah were found only during the period from April to September. The largest numbers were collected in April, June, and July.

Mites of this species possess an ovoviviparous type of repro-

[1] Part IV of an abstract from a thesis for the PhD degree, University of Utah, June, 1954. This work supported (in part) by a research grant awarded to the Brigham Young University by the Microbiological Institute, National Institutes of Health, United States Public Health Service.

duction. There is only one egg produced at a time. The egg is relatively large and occupies almost one-half the space of the idiosoma. It develops into a six-legged larva within the body of the female. Each of 236 gravid females that was collected contained one egg or larva. Gravid mites were found every month except October and December. Apparently mites of this species reproduce throughout the year in Utah.

In 22 collections of mice that were infested by *E. circularis*, this was the only mite found on its host. In the remaining collections, this species was associated with the following species the numbers of times indicated: *Haemolaelaps glasgowi*, 19; *H. megaventralis*, 1; *Eubrachylaelaps debilis*, 3; *Bryobia praetensis*, 1; *Euschongastia criceticola*, 1; *Ischyropoda armatus*, 1; *Ornithonyssus bacoti*, 3; *Dermanyssus becki*, 1; *Hirstionyssus* sp., 5; *Ornithonyssus* sp., 1; *Listrophorus* sp., 1; *Hermannia* sp., 1; *Euhaemogamasus* sp., 1; Trombiculinae sp., 1; Laelaptidae sp., 1; Trombidiidae sp., 1.

Table 1.—Species and percentages of mice infested by mites of the species *Eubrachylaelaps circularis*, 1948–1953.

	No. Mice Collected	*% Mice Infested*	*No. Mites Collected*	*Ave. No. Mites Per Infested Mouse*
P. boylii	37	0.5	145	7.4
P. crinitus	67	3.0	35	17.5
P. eremicus	201	7.0	65	4.5
P. maniculatus	2907	0.6	79	4.7
P. truei	59	50.8	68	2.3

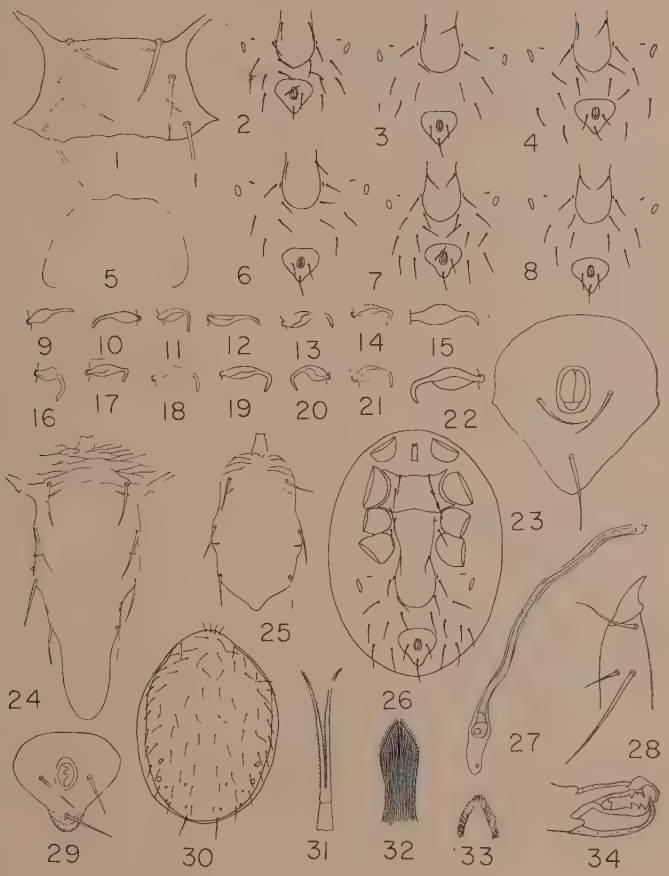
EUBRACHYLAELAPS DEBILIS Jameson, 1950

(Plate II, Figs. 37, 42, 43, 46, 48; Plate VI)

Jameson (1950) described this species from 21 females taken from *Peromyscus maniculatus* from California in February and July, 1949. Specimens taken in this study in Utah agree with the description of the type.

This species was reported from California and Oregon by Jameson (*op. cit.*). Keegan (1953) reported records from *Peromyscus maniculatus* and *P. crinitus* collected in Utah in October and November, 1951. This species is state-wide in distribution. It is known to occur at elevations between 2250 and 10,000 feet in all of the life zones from the Lower Sonoran to the Hudsonian, although it was collected most frequently in the Upper Sonoran and Transition life zones.

These mites were collected during the period from February



Explanation of Plate I

Haemolaelaps glasgowi: fig. 1, sternal plate of female; figs 2–4, 6–8, 26, arrangement of ventral setae and plates of female; fig. 5, tectum of deutonymph; figs. 9, 10, pilus dentilis of protonymph; figs. 11–16, 18–21, pilus dentilis of female; fig. 17, pilus dentilis of nymph; fig. 22, pilus dentilis of deutonymph; fig. 23, anal plate of deutonymph; fig. 24, sternal plate of deutonymph; fig. 25, sternal plate of protonymph; fig. 26, ventral view of female; fig. 27, right peritreme of female; fig. 28, ventral view of right cornicula of deutonymph; fig. 29, anal plate of female; fig. 30, dorsal plate of female; fig. 31, tritosternum of female; fig. 32, hypopharynx (labium of Strandtmann) of deutonymph; fig. 33, hypopharynx of female; fig. 34, lateral view of chelicera of female.

to October, the largest numbers being found in May and June. Those mites that were collected in western Utah south of the 38th parallel and in eastern Utah in the Colorado River Basin were found only during the period from April to July. Those north of the 38th parallel were found only during the period from February to October.

Mites of this species have an ovoviviparous type of reproduction. One mounted female was observed wherein a six-legged larva was about half-way out of the genital opening. Each of 499 females collected over a nine-month period contained one egg or larva; apparently mites of this species also produce one egg at a time.

Twenty-eight of the 111 times that it was collected, *E. debilis* was the only mite found on its host. At other times, it was associated with the following species the numbers of times indicated: *Eubrachylaelaps circularis*, 3; *E. hollisteri*, 1; *Hirstionyssus* spp., 17; *Haemolaelaps glasgowi*, 46; *H. megaventralis*, 3; *Euschongastia criceticola*, 2; *Ornithonyssus bacoti*, 3; *Shunsennia ochotona*, 1; *Radfordia lemnina*, 1; *Euhaemogamasus* spp., 7; *Dermanyssus becki*, 1; *Hypoaspis gurabensis*, 1; *Trombicula myotis*, 2; *Ischyropoda armatus*, 3; *Eulaelaps* sp., 1; Phytoseiidae sp., 3; Laelaptidae sp., 3; Parasitidae sp., 3; Gamasolaelaptidae sp., 1; Ascaidae sp., 1; Eremaeidae sp., 2; Pachylaelaptidae sp., 2.

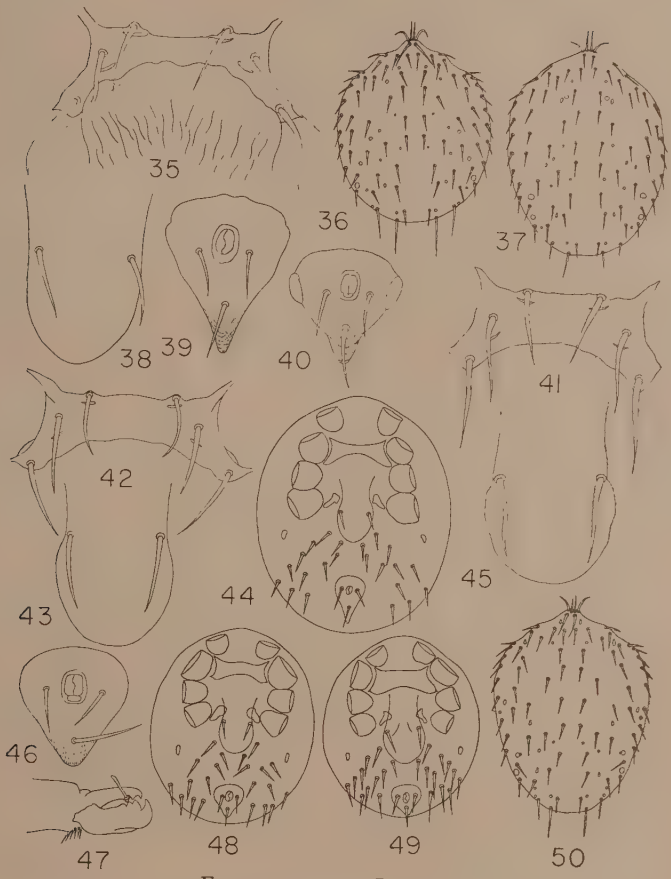
Table 2.—Species and percentages of mice infested by mites of the species *Eubrachylaelaps debilis*, 1948–1953.

	No. Mice Collected	*% Mice Infested*	*No. Mites Collected*	*Ave. No. Mites Per Infested Mouse*
P. crinitus	67	1.5	2	2.0
P. eremicus	201	1.0	2	1.0
P. maniculatus	2907	3.7	623	5.8
P. truei	59	1.7	10	10.0

EUBRACHYLAELAPS HOLLISTERI (Ewing), 1925

(Plate II, Figs. 35, 38, 39, 44, 50; Plate V)

Ewing's (1925) description of *Eubrachylaelaps hollisteri* is very general and lacks illustrations. This species should be redescribed once sufficient specimens have been collected from a broader geographic range. Ewing's type specimens were taken from caged mice of the species *Peromyscus californicus* sent to the National Zoological Park at Washington, D.C., from San



Explanation of Plate II

Eubrachylaelaps hollisteri: fig. 35, sternal plate of female, showing overlap of genitoventral plate; fig. 38, genitoventral plate of female; fig. 39, anal plate of female; fig. 44, arrangement of ventral setae of female; fig. 50, dorsal plate of female. *Eubrachylaelaps circularis:* fig. 36, dorsal plate of female; fig. 40, anal plate of female; fig. 41, sternal plate of female; fig. 45, genitoventral plate of female; fig. 47, lateral view of chelicera of female; fig. 49, arrangement of ventral setae of female. *Eubrachylaelaps debilis:* fig. 37, dorsal plate of female; fig. 42, sternal plate of female; fig. 43, genitoventral plate of female; fig. 46, anal plate of female; fig. 48, arrangement of ventral setae of female.

Francisco, California. Ewing designated the latter area as the type locality.

Mites of this species collected in this study conform to the description of the type. *E. hollisteri* probably is state-wide in distribution in Utah. It has been collected most commonly in the southern part of the state at elevations between 2250 and 5750 feet, principally in the Lower and Upper Sonoran life zones.

Table 3.—Species and percentages of mice infested by mites of the species *Eubrachylaelaps hollisteri*, 1948–1953.

	No. Mice Collected	*% Mice Infested*	*No. Mites Collected*	*Ave. No. Mites Per Infested Mouse*
P. crinitus	67	12.0	57	7.1
P. eremicus	201	10.4	70	3.4
P. maniculatus	2907	0.1	17	4.2
P. truei	59	3.4	3	1.5

A total of 147 female mites of this species was collected from 35 mice during the period from February to September, although only two mites were collected in February and one mite in September. No mites of this species were collected in March and August. The largest numbers were collected in April, May, and July.

Mites of this species have an ovoviviparous type of reproduction. Each of 115 gravid mites contained one egg or larva. Every month that this species was collected, gravid mites were present.

Twenty-five of the 35 times that it was collected, *E. hollisteri* was the only mite found on its host. At other times, it was associated with the following species the numbers of times indicated: *Trombicula belkini*, 1; *Ornithonyssus bacoti*, 1; *Brevisterna utahensis*, 2; *Hirstionyssus* spp., 3; *Eubrachylaelaps debilis*, 1; *Haemolaelaps glasgowi*, 2; *Dermanyssus becki*, 2; *Euhaemogamasus* sp., 1.

Haemolaelaps glasgowi (Ewing), 1925

(Plate I, Figs. 1–34; Plate IV)

Ewing (1925) described *H. glasgowi* from a single female specimen collected from a "wild rat" at Urbana, Illinois in 1912. Strandtmann (1949) discussed the synonymy, morphology and variations of this and related species of *Haemolaelaps*. Specimens

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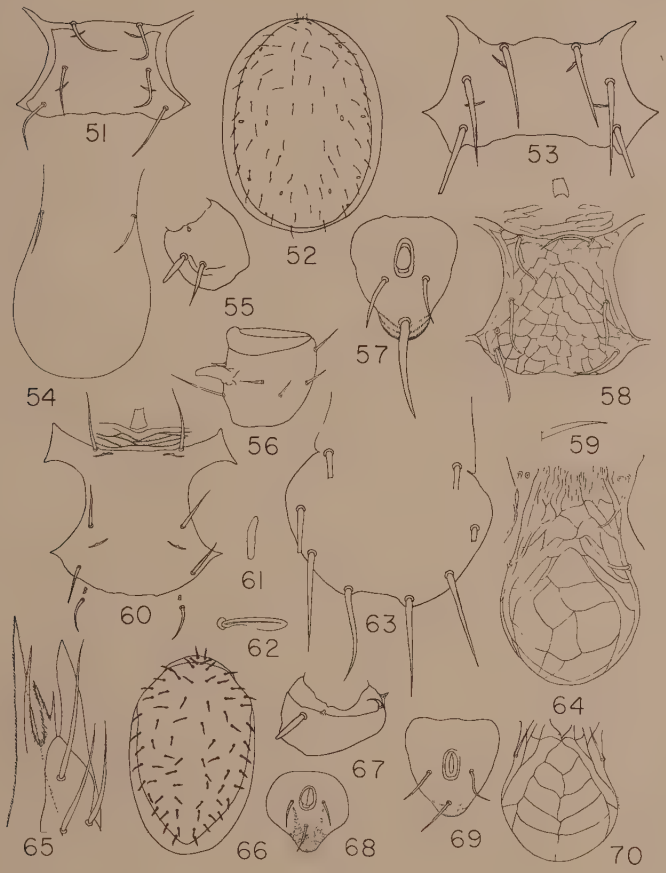
Explanation of Plate III

Haemolaelaps megaventralis: fig. 51, sternal plate of female; fig. 52,



dorsal plate of female; fig. 54, genitoventral plate of female; fig. 59, pilus dentilis of female; fig. 61, metapodal plate of female; fig. 69, anal plate of female. *Laelaps nuttalli:* fig. 53, sternal plate of female; fig. 55, ventral view of right coxa I of female; fig. 57, anal plate of female; fig. 63, genitoventral plate of female; fig. 67, ventral view of right coxa II of female. *Hypoaspis leviculus:* fig. 56, ventral view of right femur II of female; fig. 58, reticulation of sternal plate of female; fig. 64, gentioventral plate of female, showing reticulation, metasternal setae and pores. *Hypoaspis gurabensis:* fig. 60, sternal plate of female; fig. 62, dorsal seta of female; fig. 65, ventral view of left half of gnathosoma of female; fig. 66, dorsal plate of female; fig. 68, anal plate of female; fig. 70, reticulation of genitoventral plate of female.

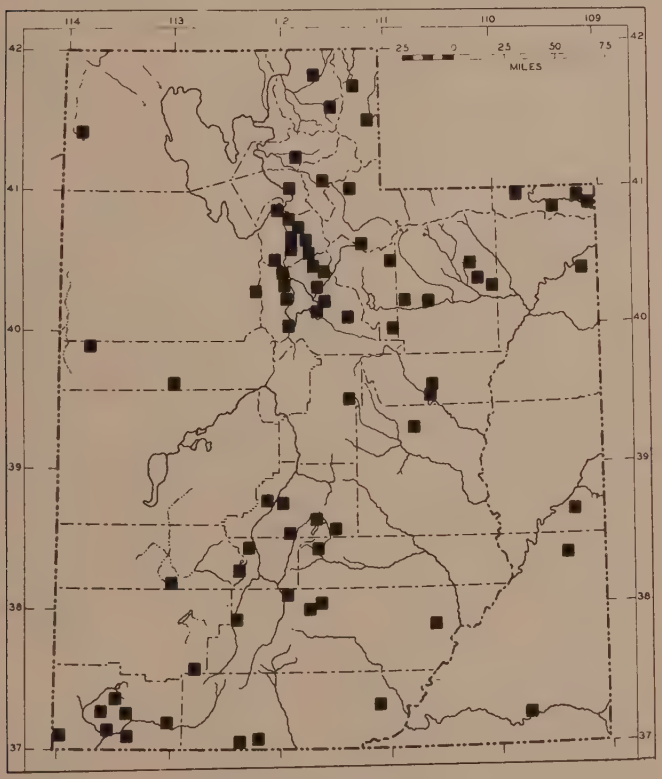
of this species from Utah collected in this study show some variations in the distance between the anal and genitoventral plates, and the amount of inflation and recurvation of the pilus dentilis. In Strandtmann's (*op. cit.*) key to the species of *Haemolaelaps*, he separated *H. glasgowi* and *H. geomys* partly on the basis of the amount of curvature of the slender terminal portion of the pilus dentilis. Mites collected in this study vary considerably with reference to the amount of curvature of this structure. Because of its variability, it appears that the pilus dentilis should be used primarily to separate the species into major groups rather than to separate two distinct species. In some specimens from Utah, the distance betwen the anal and genitoventral plates approaches that which is distinctive of specimens of *H. megaventralis*. A considerable range of variation in the distance between these ventral plates occurs in *H. glasgowi*. Strandtmann (*op. cit.*) stated that there are certain intraspecific differences which are apparent when comparing specimens from one host with those of another. These differences also occur between specimens from the same animal host, especially where large numbers of mites are concerned.

Mites of this species apparently have a preference for the Rodentia, although *H. glasgowi* has been taken from a variety of habitats and hosts including birds. It is known to occur principally in the western hemisphere and has been reported from almost all of the United States. Keegan (1953) reported that mites of this species occur on animals of the following species in Utah: *Citellus leucurus*, *Eutamias minimus*, *Onychomys leucogaster*, *Reithrodontomys megalotis*, *Peromyscus crinitus*, *P. maniculatus*, *Dipodomys ordii*, and *D. microps*. This species of mite is statewide in distribution in Utah at elevations between 2250 and 10,000 feet in all of the life zones from the Lower Sonoran to the Hudsonian. It has been collected most frequently in the Lower Sonoran and Transition life zones.

Haemolaelaps glasgowi was the species collected most frequently during this study. A total of 1253 mites representing 1080 females, 79 males and 94 nymphs was collected from 316 mice. According to Strandtmann (*op. cit.*), mites of this species may be recovered during any season that the host can be captured. In this study, mites were collected every month. There were twice as many found in June than in any other month. The largest numbers

were collected during the period from April to August, and there was a conspicuous decline in the numbers of mites taken in September. During the winter, early spring, and autumn months, the numbers of mites collected were sufficiently low to be indicative of a seasonal fluctuation.

These mites have an ovoviviparous type of reproduction, and give birth to the first nymphal form (Strandtmann, *op. cit.*). Only one egg develops and matures at a time, and the larval stage is passed within the body of the female. Each of 252 gravid females found in this study contained only one egg, larva or nymph. Each



EXPLANATION OF PLATE IV

Collection localities of *Haemolaelaps glasgowi* in Utah.

egg was of a large size and occupied almost one-half the idiosoma. Many females were engorged with blood, and some of these engorged specimens were gravid. Gravid females were collected every month except November and December. Mites of this species probably reproduce throughout the year in Utah.

Male mites were collected every month except May and September; they were most abundant in April. Nymphs were collected every month except January, August and September; largest numbers were found in June and July.

Table 4.—Species and percentages of mice infested by mites of the species *Haemolaelaps glasgowi*, 1948–1953.

	No. Mice Collected	*% Mice Infested*	*No. Mites Collected*	*Ave. No. Mites Per Infested Mouse*
P. boylii	37	21.6	48	6.0
P. crinitus	67	1.5	1	1.0
P. eremicus	201	8.4	36	2.1
P. maniculatus	2907	9.7	1158	4.1
P. truei	59	13.5	10	1.3

Mites of this species were associated with other mites belonging to more than 40 species. There were fluctuations in the numbers of mites that were associated with *H. glasgowi* during the five years that collections were made. There were also variations in the numbers of kinds of mites associated with this species.

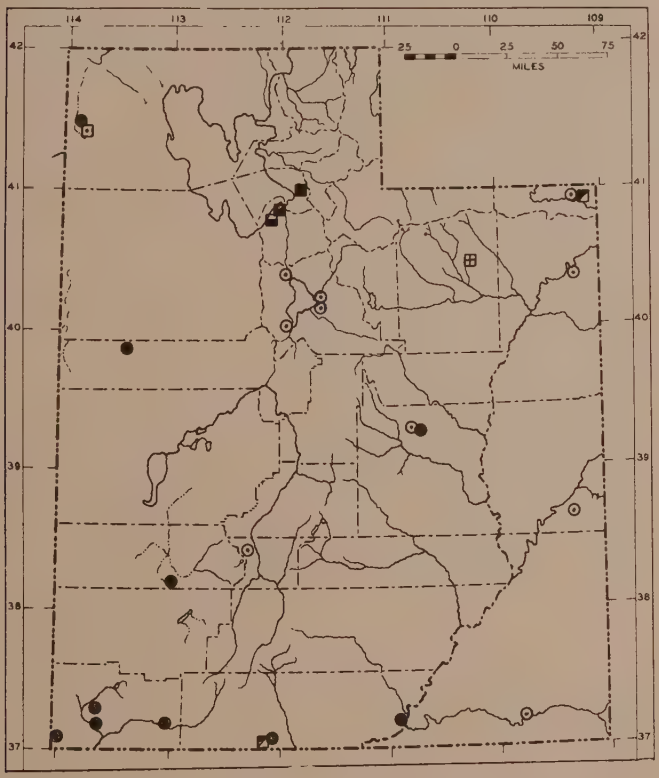
Haemolaelaps megaventralis (Strandtmann), 1947

(Plate III, Figs. 51, 52, 54, 59, 61, 69; Plate V)

Strandtmann (1947) described this species from specimens collected from a gray squirrel from Georgia. The mites collected in this study agree in most morphological respects with the description of the type. Strandtmann (1947, 1949) stated that mites of this species have a slight preference for squirrels and birds, although they have been taken from a variety of mammals. *Haemolaelaps megaventralis* has been reported from several countries of both the northern and southern hemispheres. In North America, records are known from eastern and western United States, Mexico, and Canada. In Utah, this species probably is state-wide in distribution. It has been collected at elevations between 4000 and 5750 feet in the Upper Sonoran Life zone.

Table 5.—Species and percentages of mice infested by mites of the species *Haemolaelaps megaventralis*, 1948–1953.

	No. Mice Collected	*% Mice Infested*	*No. Mites Collected*	*Ave. No. Mites Per Infested Mouse*
P. maniculatus	2907	0.3	11	1.4
P. truei	59	15.0	14	1.5



Explanation of Plate V

Collection localities of *Eubrachylaelaps hollisteri, Haemolaelaps megaventralis, Hypoaspis gurabensis, H. leviculus, Laelaps multispinosus, L. nuttali,* and *Typhlodromus mariposus* in Utah.

Thirteen nymphs, one male, and 11 females were collected from 17 mice in April, May, June, and November. Four of the 23 times that it was collected, *H. megaventralis* was the only mite found infesting its host. At other times, it was associated with the following species the numbers of times indicated: *Eubrachylaelaps debilis*, 3; *Haemolaelaps glasgowi*, 4; *Ischyropoda armatus*, 1; *Euhaemogamasus ambulans*, 1; *Hirstionyssus* sp., 4; *Garmania* sp., 2; *Hypoaspis* sp., 1; *Eulaelaps* sp., 1; *Rhizoglyphus echinopus*, 1; *Glycyphagus* sp., 1; Neoparasitidae sp., 1; Cunaxidae sp., 1.

Hypoaspis gurabensis (Fox), 1946

(Plate III, Figs. 60, 62, 65, 66, 68, 70; Plate V)

Fox (1946) described *H. gurabensis* from a single female collected from a "domestic rat or mouse" from Puerto Rico. The mites collected in this study in Utah conform to the description of the type. This species probably is statewide in distribution, but was not commonly found on mice of the genus *Peromyscus*. Mites were found at elevations between 5000 and 5500 feet in the Upper Sonoran life zone.

Fox (*op. cit.*) suggested that mites of this species probably are parasites or associates of ants. If this is true, it is probable that the infestations of mice in this study were accidental and occurred from the scavenger ants that visited the carcasses of trapped mice. Four females of this species were collected in May and June.

Hypoaspis leviculus (Eads), 1951

(Plate III, Figs. 56, 58, 64; Plate V)

Mites of this species collected in this study vary only slightly from the description of the type. Eads (1951) described the type specimen as having one large pair and one small pair of metapodal plates. Mites collected in this study have one large pair and three or four small pairs. The peritremes of the type specimens extend beyond coxae I; in the mites from Utah the peritremes end at the anterior fourth of coxae I.

The type specimens were collected in Texas from pocket mice, *Perognathus hispidus*, grasshopper mice, *Onychomys leucogaster*, and cotton rats, *Sigmodon hispidus*. Eads, *et al* (1952) reported additional collections from grasshopper mice from Texas. Keegan (1953) recorded this species from *Perognathus parvus*, *Peromyscus maniculatus*, *P. crinitus*, and *O. leucogaster* from Utah. In

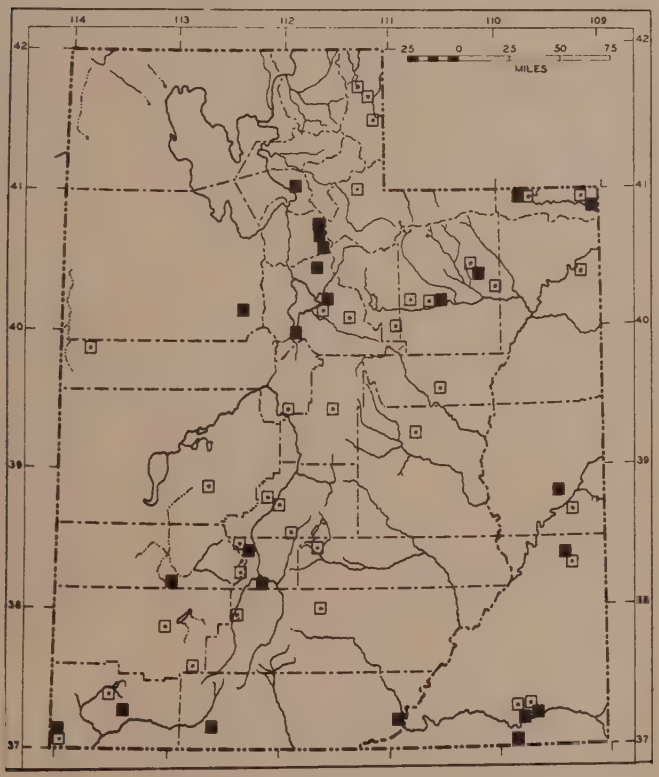
this study. two females were collected in October at an elevation of about 4500 feet in the Upper Sonoran life zone.

Laelaps multispinosus Banks, 1909

(Plate V)

Banks (1909) described this species from specimens taken from a muskrat from Canada. The single female collected in this study conforms to the description of the type.

According to Tipton (unpublished manuscript), mites of this genus parasitize animals that dwell in water or marshy habitats. Animals of other kinds possibly are accidentally infested by these



Explanation of Plate VI

Collection localities of *Eubrachylaelaps debilis* and *E. circularis* in Utah.

mites when they wander into marshy habitats. The female mite in this study was collected from a mouse taken from a marshy area west of Salt Lake City, Salt Lake County, in October.

LAELAPS NUTTALLI Hirst, 1915

(Plate III, Figs. 53, 55, 57, 63, 67; Plate V)

One female mite of this species was collected in March from a mouse from Bluebell, Duchesne County, at an elevation of about 6500 feet in the Upper Sonoran life zone. Other species associated with *L. nuttalli* are *Hirstionyssus occidenalis* and *Euschongastia criceticola.*

Table 6.—Checklist and host correlation of the numbers and kinds of mites of the families Laelaptidae and Phytoseiidae taken from each of five species of *Peromyscus.*

	No. Mites Taken From Each Species Of *Peromyscus*				
Species of Mite	*P. boylii*	*P. crinitus*	*P. eremicus*	*P. maniculatus*	*P. truei*
Eubrachylaelaps circularis	145	35	65	79	68
Eubrachylaelaps debilis		2	2	623	10
Eubrachylaelaps hollisteri		57	70	17	3
Haemolaelaps glasgowi	48	1	36	1158	10
Haemolaelaps megaventralis				11	14
Hypoaspis gurabensis				4	
Hypoaspis leviculus				2	
Laelaps multispinosus				1	
Laelaps nuttalli				1	
Typhlodromus mariposus				17	

PHYTOSEIIDAE

TYPHLODROMUS MARIPOSUS (Fox), 1946

(Plate V)

Fox (1946) described this species from two females collected from "*Rattus* species or *Mus m. musculus*" and from rats, *R. norvegicus*, from Puerto Rico. Thurman and Branch (1948) re-

ported this species from *R. norvegicus* from Florida. In this study, 17 female mites were collected in September, October, and November.

Discussion

In Utah, mites of several species most commonly occur in certain faunal areas. *Eubrachylaelaps hollisteri* and *Haemolaelaps megaventralis* are generally southern in distribution. *Eubrachylaelaps hollisteri* apparently has extended its range into Utah from the south by way of the Virgin River and Colorado River drainages, and the valleys of eastern Nevada in the Great Basin area. *Haemolaelaps megaventralis* apparently has extended its range northward into Utah by way of the Colorado River drainage.

Mites of certain species, although not host specific, are associated more frequently with one kind of white-footed mouse than with another. Mites of the species *H. megaventralis* and *E. circularis* were found most frequently on *Peromyscus truei*, and *E. hollisteri* on *P. crinitus*. Such a frequent association allows a mite species to rapidly extend its range to correspond to the range of its preferred host, as long as climatic conditions are favorable for the survival of the mites. Mites of the species *H. megaventralis* were found almost exclusively in those areas which correspond to the known distribution of mice of the species *P. truei*. Mites of the species *E. hollisteri* apparently are also restricted to the range of their preferred *Peromyscus* hosts, yet mites referrable to *E. circularis* are not restricted to the range of their "preferred" host, *P. truei*. Mites of the species *E. debilis* and *H. glasgowi* were not found in a majority on any one kind of mouse, and were widely distributed over the entire area of the state.

Mites are influenced in their activity and reproductive periods by climatic conditions. In the Upper Sonoran and Transition life zones in Utah, *H. megaventralis*, *E. circularis*, and *E. debilis* were found on mice most frequently during the period from May to September. In the Lower Sonoran zone and similar areas, *E. hollisteri* was most abundant on mice during the period from May to July.

Haemolaelaps glasgowi occurs on mice of the genus *Peromyscus* in Utah more frequently and in larger numbers than mites of any other species. Next in frequency of occurrence are mites of the three species of *Eubrachylaelaps*: *E. circularis*, *E. debilis*, and

E. hollisteri. *Hirstionyssus occidentalis* also is commonly found on *Peromyscus* (Allred, unpublished manuscript).

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A FORMOSAN APHID, MICROMYZUS FORMOSANUS TAKAHASHI, ON SHALLOTS IN CALIFORNIA

(Homoptera: Aphididae)

E. O. Essig

University of California, Berkeley, California

In the fall of 1953, an elderly gentleman brought to our office in Agriculture Hall, University of California, a few plants of shallots, or eschallots, *Allium ascalonicum*, which he thought were being injured by an insect. However, a rather close examination did not reveal the nature of the trouble, and I took the plants home and planted them in the garden for further observations. During the past, the tops of these plants were occasionally used

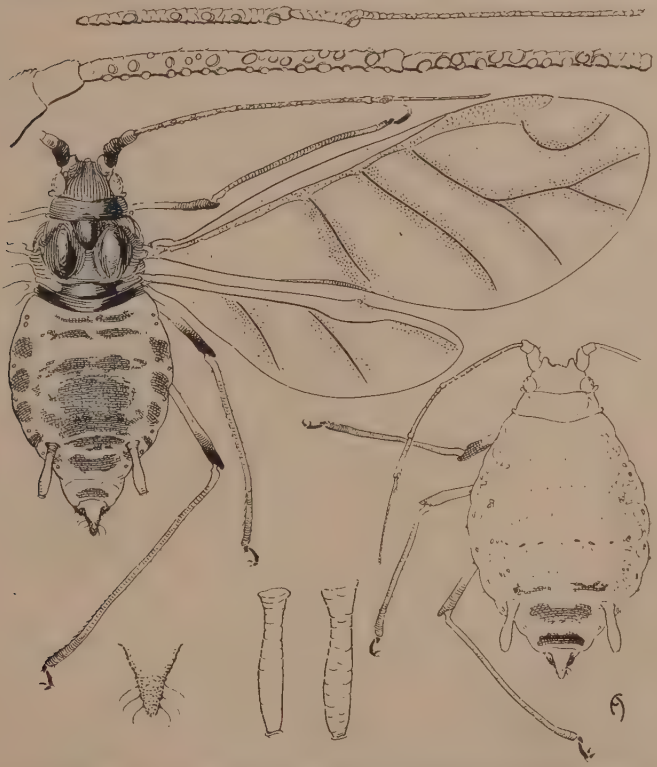

Fig. 1. *Micromyzus formosanus* Takahashi (Drawings by Frieda Abernathy)

for seasoning certain foods, without noticing any insect infestations even under close scrutiny.

Fortunately on November 10, 1956, the writer was asked to gather some shallot tops for culinary purposes. In so doing, he discovered that one clump, containing many plants, was heavily infested with a cloudy-winged aphid which was at once recognized as the shallott aphid, *Micromyzus formosanus* Takahashi. An intensive scanning of the literature revealed that this aphid was first collected on *Polygonium chinensis*, at Taihoku, on the island of Formosa, and was described as *Myzus formosanus* by Ryoichi Takahashi in March, 1923, in Report No. 4 Aphididae of Formosa, Part 2, Department of Agriculture, Government of Formosa. Taihoku, in March, 1923; and also in Report No. 22, Part 5, p. 68, May, 1931.

Dr. Orhez Shinji, in his 1215-page work on the Japanese Aphididae, lists *Myzus formosanus* Takahashi on *Polygonium chinensis* in Formosa in 1941.

The most complete and important paper devoted to this insect is that of J. P. Doncaster and B. Kassanis, of the Rothamsted Experimental Station, Harpenden, England, in the Annals of Applied Biology, Vol. 33, No. 1, pp. 65–68, Plate 6, Fig. 1. August 1945.

As near as I can ascertain at the present time, this aphid has been reported as occurring in the Japanese districts of Batoran, Shinton, Tokyo and Toyen; in sixteen localities in Great Britain, and at Berkeley, California. The recorded host plants are chiefly members of the Lilaceous family, and more particularly on *Allium* spp.

TEMNOSOMA, A GENUS OF BEES NEW TO THE UNITED STATES

(Hymenoptera: Halictidae)

A female of *Temnosoma smaragdinum* Smith was collected at Tucson, Aricona, June 25, 1932 by R. H. Crandall. This specimen has the transverse striae at apex of the enclosure of propodeum so faint as to be discernible only in certain lights, but Smith, in the original description, states these are more or less obsolete in different examples. The species was described from southern Mexico, and has been recorded by Cockerell from Cordoba and San Rafael in Vera Cruz. Our specimen belongs in the collection of the University of Arizona, at Tucson.—P. H. TIMBERLAKE, *University of California, Riverside.*

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RECENT COLLECTIONS OF MALLOPHAGA AND ANOPLURA FROM SOUTHERN CALIFORNIA[1]

RAYMOND E. RYCKMAN AND ROBERT D. LEE
Department of Entomology, School of Tropical and Preventive Medicine, College of Medical Evangelists, Loma Linda, California

Lice have not been collected or adequately studied in many sections of the United States; Southern California is not an exception in this regard.

The biting and sucking lice herein reported were collected from mammals and birds caught during investigations concerned with insecticide studies for the control of ectoparasites under field conditions and studies on *Neotoma*, the host for Triatominae. A limited number of specimens was contributed by friends who knew of our interests in Mallophaga and Anoplura. This material was collected from 1951–1954 in five counties of Southern California: Orange, San Diego, Riverside, San Bernardino, and Inyo Counties; two collections are included which were made a few miles outside the state of California: one in Yavapai County, Arizona, the other in Northern Baja California, Mexico. The collections listed represent several new county, state, and host records.

During the time the specimens were accumulated the authors were assisted by C. T. Ames, K. Y. Arakawa, C. P. Christianson, B. A. Deem, K. C. Fischer, C. C. Lindt, and D. Spencer. The authors also acknowledge with appreciation the assistance of Lt. John I. Scanlon who identified the lice, and Dr. Henry W. Setzer who identified a number of the mammals. Mr. W. C. Hanna very kindly rendered counsel on certain taxonomic problems with the birds.

The fourth edition (1931) of the *American Ornithological Union's Check List of North American Birds (With Supplements)* was used as the authority for the birds discussed, and the *List of North American Recent Mammals* by Miller and Kellogg (1955) was the taxonomic authority for the mammals. Supplementary works on birds and mammals also used were Allen (1951), Harrison (1955), Hoffman (1927), Hooper (1938), Ingles (1954), and Orr (1940). *The Sucking Lice* by Ferris (1951), and *A Check List of the Genera and Species of Mallophaga* by Hopkins

[1] Collection of a major portion of the material presented in this paper was made possible by a contract (DA-49-007-MD-185) from the Research and Development Division, Office of the Surgeon General, Department of the Army.

and Clay (1952) were found to be valuable references on the sucking and biting lice.

ANOPLURA

Hoplopleuridae:

Hoplopleura acanthopus (Burmeister, 1839)

Microtus californicus sanctidiegi Kellogg, 1922 (meadow mouse)—*San Juan Capistrano, Orange County, California, September 10, 1951; *Camp Pendleton, Oceanside, San Diego County, California, March 8, 1953; and *Reche Canyon, Riverside County, California, January 6, 1953. Previously reported from *Microtus constrictus* Mendocino City; *M. californicus*, Covelo; and *Microtus* sp., South Yolla Bolly Mt., California (Ferris, 1921).

Hoplopleura hesperomydis (Osborn, 1891)

Peromyscus maniculatus gambelii (Baird, 1858) (deer mouse)—*Whitney Portal, 13 miles west Lone Pine, Inyo County, California, September 27–30, 1951. Previously reported from Yosemite National Park on *P. maniculatus*; on *Onychomys torridus pulcher*, San Bernardino County; and on *Mus musculus* from Stanford University (Ferris, 1916).

Peromyscus maniculatus sonoriensis (LeConte, 1853) (deer mouse)—*Reche Canyon, Riverside County, October 11, 1951.

Peromyscus boylii rowleyi (Allen, 1893) (brush mouse) — *Reche Canyon, Riverside County, October 12, 1951; and seven miles south Congress Junction, Yavapai County, Arizona, December 17, 1952: Previously reported from California on *Peromyscus boylii* and on *Mus musculus* at Stanford University (Ferris, 1921).

Haemodipsus setoni Ewing, 1924

Sylvilagus audubonii sanctidiegi (Miller, 1899) (Audubon cottontail rabbit)—*Camp Pendleton, Oceanside, San Diego County, California, August 13 and November 25, 1952; and *Loma Linda, San Bernardino County, California, January 19 and 23, 1953. Previously reported from *Lepus californicus* in California (Ferris, 1932).

Polyplax abscisa Fahrenholz, 1938

Microtus californicus sanctidiegi Kellogg, 1922 (meadow mouse)—*San Juan Capistrano, Orange County, California, September 10, 1951; *Camp Pendleton, Oceanside, San Diego County, California, March 8, 1953; and *Reche Canyon, Riverside County, California, January 6, 1953. This louse has previously been reported on *Microtus* sp. at South Yolla Bolly Mt., California; *M. californicus* from Marin County, California; and on *M. intermedius* from Nevada (Ferris, 1942).

Neohaematopinus laeviusculus (Grube, 1851)

Citellus beecheyi beecheyi (Richardson, 1829) (Calif. ground squirrel)—*San Juan Capistrano, Orange County, California, August, 1951–March, 1952; Dana Point, Orange County, California, October, 1951–March, 1952, May–September, 1952, November and December, 1952, and June, 1953; *Camp Pendleton, Oceanside, San Diego County, California, March and April, 1952, and June–November, 1952; and *Corona, Riverside County, California, August, 1952.

Citellus beecheyi parvulus Howell, 1931 (Calif. ground squirrel)—*Loma Linda, San Bernardino County, California, November, 1951, February and March, 1952, July–November, 1952, and February, April, May and July, 1953; and *Mt. San Jacinto, Riverside County, California, June, 1952.

N. laeviusculus is at times very abundant on *Citellus beecheyi* during the spring months; however, the above collection records from 446 hosts indicate that this louse occurs on ground squirrels in Southern California throughout all of the year including the hot, dry summer months. This louse has previously been reported from *C. beecheyi, C. b. douglasii,* and *C. beldingi* in California (Ferris, 1923).

Neohaematopinus neotomae Ferris, 1942

Neotoma fuscipes simplex True, 1894 (dusky-footed wood-rat)—*Lake Mathews Canyon, Riverside County, California, December 13, 1951.

Neotoma fuscipes macrotis Thomas, 1893 (dusky-footed wood-rat)—*Mill Creek Canyon, San Bernardino County, California, March 17 and 26, 1953.

†*Neotoma lepida intermedia* Rhoads, 1894 (desert wood-rat) —**Reche Canyon, Riverside County, California, January 6, 1953.

Neohaematopinus neotomae has previously been reported from *Neotoma albigula* at Tucson, Arizona; *Neotoma fuscipes streatori* at Monterey, California; and *Hodomys alleni* at Manzanillo, Mexico (Ferris, 1942).

MALLOPHAGA

Trichodectidae:

Trichodectes osborni (Keler, 1944)

†*Spilogale gracilis microrhina* Hall, 1926 (spotted skunk)—*Reche Canyon, Riverside County, California, October 3, 1951; and *Dana Point, Orange County, California, October 22, 1952. New host record for this subspecies.

Trichodectes mephitidis (Packard, 1873)

Mephitis mephitis holzneri Mearns, 1897 (striped skunk)—*San Juan Capistrano, Orange County, California, October 4, 1951.

Trichodectes minutus (Paine, 1912)

Mustela frenata latirostra Hall, 1936 (long-tailed weasel) — *Loma Linda, San Bernardino County, California, March 25, 1952 and May 17, 1953; and *Camp Pendleton, Oceanside, San Diego County, California, April 3, 1952.

Geomydoecus californicus (Chapman, 1897)

Thomomys bottae (Eydoux and Gervais, 1836), (botta pocket gopher) —*Loma Linda, San Bernardino County, California, November 21 and 25, December 7 and 16, 1951, January 21, March 3, October 14, and December 19, 1952, and January 21–24, 1953; and San Jose, Baja California, Mexico, November 8, 1953.

Mustela frenata latirostra Hall, 1936 (long-tailed weasel) — *Loma Linda, San Bernardino County, California, December 6, 1951 and March 24, 1952.

Menoponidae:

COLPOCEPHALUM UNCIFERUM Kellogg, 1896

Pelecanus erythrorhynchos Gmelin, 1789 (white pelican)—*Mentone, San Bernardino County, California, March 17, 1954.

PSEUDOMENOPON PACIFICUM (Kellogg, 1896)

Fulica americana americana Gmelin, 1789 (coot or mud-hen)—*Lakeview, Riverside County, California, December 24, 1953.

PSEUDOMENOPON sp.

Grebe (this host was not identified to species)—*San Juan Capistrano, Orange County, California, November 1, 1951.

DENNYUS sp.

Aeronautes saxatalis saxatalis (Woodhouse, 1853) (white-throated swift)—*Loma Linda, San Bernardino County, California, December 31, 1953. The single specimen collected was a nymph and could not be taken to species.

PIAGETIELLA PERALIS (Leidy, 1878)

Pelecanus erythrorhynchos Gmelin, 1789 (white pelican)—*Mentone, San Barnardino County, California, March 17, 1954.

TRINOTON sp.

Mergus merganser americanus Cassin, 1852 (American merganser duck)—*Mentone, San Bernardino County, California, March 17, 1952.

Anas cyanoptera cyanoptera (Vieillot, 1816) (Cinnamon teal duck)—*Loma Linda, San Bernardino County, California, December 27, 1953.

HOHORSTIELLA LATA (Piaget, 1880)

Columba livia livia Gmelin, 1789 (rock dove or domestic pigeon)—*Loma Linda, San Bernardino County, California, November 29, 1953.

Ricinidae:

RICINUS SUBHASTATUS (Durrant, 1906)

Pipilo fuscus crissalis (Vigors, 1839) (brown towhee)—*San Jose, Baja California, November 6, 1953.

Laemobothriidae:

LAEMOBOTHRION BUTEONIVORUM (Packard, 1872)

Buteo swainsoni Bonaparte, 1838 (Swainson's hawk)—*Loma Linda, San Bernardino County, California, October 12, 1953.

Philopteridae:

ANATICOLA CRASSICORNIS (Scopoli, 1763)

Anas cyanoptera cyanoptera (Vieillot, 1816) (cinnamon teal duck)—*Loma Linda, San Bernardino County, California, December 27, 1953.

ANATICOLA MERGISERRATI (DeGeer, 1778)

†*Mergus merganser americanus* Cassin, 1852 (American merganser duck)—*Mentone, San Bernardino County, California, March 17, 1952. The only North American record of *Anaticola* from mergansers in Wilson's (thesis) record of this species from *Mergus serrator, in litt.* Scanlon.

COLUMBICOLA COLUMBAE (Linnaeus, 1758)

Columba livia livia Gmelin, 1789 (rock dove or domestic pigeon)—*Loma Linda, San Bernardino County, California, September 29, 1953.

AQUANIRMUS AMERICANUS (Kellogg and Chapman, 1899)

Grebe (this host was not identified to species)—*San Juan Capistrano, Orange County, California, November 1, 1951.

STRIGIPHILUS SPEOTYTI (Osborn, 1896)

Speotyto cunicularia hypugaea, Bonaparte, 1825) western burrowing owl)—*Dana Point, Orange County, California, December 17 and 18, 1951.

DEGEERIELLA GIEBELI (Hopkins, 1947)

Buteo jamaicensis culurus Cassin, 1855 (red-tailed hawk) — *Loma Linda, San Bernardino County, California, December 17, 1953.

SUMMARY

The material presented above was collected from 1951–1954 in five counties of Southern California: Orange, San Diego, Riverside, San Bernardino, and Inyo Counties; two collections are included which were made a few miles outside of California: one in Yavapai County, Arizona, the other in Northern Baja California, Mexico. Six species of Anoplura were associated with twelve hosts which constituted nineteen county records, one state record, and one host record. Nineteen species of Mallophaga were associated with twenty-one hosts and comprised twenty-two county records, one state record, and two host records.

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† New host record.
* New county record.
** New State record.

LONGEVITY OF SOME ANTHOPHORID BEE LARVAE
(Hymenoptera: Apoidea)

Large collections of anthophorid bee cells containing overwintering larvae have been brought into the laboratory and held for long periods of time. Usually these larvae pupate and emerge at about the same time as those in the field. A few may fail to transform and die after a protracted period in the larval stage. An exception occurred with 10 of 75 larvae of *Melissodes robustior* Cockerell collected near Marsh Creek Canyon, Contra Costa County, California on November 4, 1954. This bee is a fall emerging species and its burrows were located in a layer of moist clay in the bed of an intermittent stream. These cells were kept in pill boxes and were next examined in February, 1957. All but ten had transformed to the adult stage and these ten larvae were removed from their cells and placed in separate pill boxes. All of them pupated in April or early May, 1957 and developed into one male and nine females. (However, only three females became perfect adults with fully expanded wings.) It is apparent that the ability to prolong the resting stage would be of considerable adaptive value to desert-dwelling forms but its significance for this species is not clear.—J. W. MACSWAIN, *University of California, Berkeley*.

REARING RECORDS FOR SOME CALIFORNIA CERAMBYCIDAE

JOHN A. CHEMSAK
University of California, Berkeley

During the early part of 1957, dead tree branches and limbs were collected in the areas around San Francisco Bay. All of the wood material was boxed and caged in the laboratory and the adult cerambycids were collected as they emerged. Five different species were reared from three different hosts.

PHYMATODES NITIDUS LeConte

A total of nine females and five males of this species were reared from Sargent cypress, *Cupressus goveniana* Gord., collected at Carson Ridge, Marin County, California, on January 9, 1957. The selected material consisted of small dead branches which were attached to the trees. Emergence of adults began on March 7 and continued until April 27.

NECYDALIS CAVIPENNIS LeConte

N. cavipennis was reared from a small dead trunk section of California live oak, *Quercus agrifolia* Nee., which was in a fairly advanced state of decay. The material was collected at Strawberry Canyon, Berkeley Hills, Alameda County, California, on January 14, 1957. Emergence dates of the adults were from April 19 to April 26 with a total of five females being taken.

XYLOTRECHUS NAUTICUS Mannerheim

Two specimens were reared from the thick bark of California live oak collected in the Berkeley Hills on March 10, 1957. A female emerged on April 13 and a male on May 6.

XYLOTRECHUS INSIGNIS LeConte

One specimen, a male, emerged from willow, *Salix* sp., on April 4, 1957. The host material was collected two miles west of Pittsburg, Contra Costa County, California, on March 21, 1957.

SAPERDA HORNI Joutel

This species was reared from willow collected two miles west of Pittsburg, California. Willow limbs were brought in on two dates, February 15 and March 21. One male emerged from the

latter on May 6 and three males and one female from the former in May.

A few observations were made in the field on the habits of the larvae of *S. horni*. These appear to bore in the heartwood of living branches of willow making their galleries up the center of limbs. The galleries are about one-half inch in diameter and are loosely packed with dark-brown, moist frass.

AN ATTRACTANT FOR TWO SPECIES OF CERAMBYCIDAE

(Coleoptera)

A long series of *Dendrobias mandibularis mandibularis* Audinet-Serville was taken under somewhat unusual circumstances on July 18, 1957 by C. W. O'Brien in Arizona. While stopping at a roadside picnic stand 15 miles north of Rock Springs, Yavapai County, he observed large numbers of cerambycids in the trash barrels. These beetles were being attracted by watermelon rinds in the barrels. A total of 32 males and 34 females were collected. Mr. O'Brien mentioned, however, that this series was merely a sample of the total number present.

Also taken with this series of *Dendrobias* were two females of *Eustromula validum* (LeConte). No other specimens of this species were observed at the time. Little is known of the food habits of the adults of these two species. Schwarz[1] states that those of *Dendrobias* are especially fond of printers ink and sometimes obliterate the large letters on the posters of theatrical performances, etc., which are pasted on walls and fences.

D. mandibularis, while not an uncommon species in the southwestern United States, is seldom observed in such profusion, and long series from any one locality are scarce as a rule. *E. validum*, on the other hand, is seldom numerous except at light. Use of watermelon as bait may offer a fairly good method for collecting series of this species.

The attractive powers of watermelon have been shown for other groups of insects. For instance, Bohart[2] reporting on mating habits of halictid bees, reported that several species of bees were observed on fermenting juice of watermelon.—JOHN A. CHEMSAK, *University of California, Berkeley*.

[1] Schwarz, E. A. Food habits of longicorn beetles. Proc. Ent. Soc. Wash., 6:21-22. 1904.

[2] Bohart, G. E. Observations on the mating habits of halictid bees. Pan-Pac. Ent., 26, (1):34-3. 1950.

A NEW SUBSPECIES OF THE GENUS CICINDELA

(Coleoptera: Cicindelidae)

D. K. DUNCAN

Globe, Arizona

Cicindela tranquebarica cibecuei Duncan, new subspecies

Uniformly robust form. Elytra brilliant dark navy blue in sunlight, appearing black under artificial light. Typical but massive white markings, similar to *C. tranquebarica kirbyi* LeConte.

Body dark shining blue beneath. Legs dark blue. Femora clothed with stiff, erect white hairs. Tibiae with stiff white hairs about one third the length of those on the femora and less dense. Sides of thorax and abdomen clothed with dense, erect white hairs. Middle of abdominal segments with scattered inconspicuous, long, fine white hairs. Thorax above, deep navy blue, with sparse, erect, white hairs, becoming more numerous laterally. Head deep navy blue, vertex and cheeks naked, front and palpi with long erect white hairs. Labrum and base of mandibles ivory white. Length: 12–14 mm. Width: 5–6 mm.

The deep blue color with no cupreous or brassy reflections, and the broad, often connected elytral markings readily distinguish this subspecies.

The type series of 119 specimens vary by having the markings connected laterally on 21; the humeral and median lunules only connected laterally on 14; the median and apical lunules only connected on 10; the remaining 74 having these markings very narrowly separated.

The markings are extremely uniform through a large series taken from several localities on Cibecue Creek, Arizona, in 1953, 1954 and 1956.

Holotype male, CIBECUE CREEK, NEAR CIBECUE, GILA COUNTY, ARIZONA, April 22, 1956, D. K. Duncan. *Allotype female*, same data as holotype, April 8, 1953, D. K. Duncan. *Paratypes*, same data, seven specimens, D. K. Duncan, R. A. Tunis and Ralph Premeau, April 8, 1953; 50 specimens, D. K. Duncan, April 15, 1954; 60 specimens, D. K. Duncan and F. H. Parker, April 22, 1956.

The holotype and allotype together with 18 paratypes have been deposited in the American Museum of Natural History, New York City. Twenty paratypes have been deposited in the University of Arizona collection, Tucson, Arizona.

I am indebted to Dr. Mont A. Cazier, Curator, American Museum of Natural History, for examination of this insect and comments, and to Mr. Frank H. Parker of Globe, Arizona, for helpful comments.

AN EARLY RECORD OF THE KHAPRA BEETLE IN ARIZONA[1]

M. W. Nielson
University of Arizona, Tucson

Armitage (1935) reported the first record of occurrence of the khapra beetle. *Trogoderma granarium* Everts, in the United States. According to Allen and Linsley (1954), specimens were identified from infested grain in two warehouses in Tulare County, Calif., in October, 1953. Armitage (1954) stated that the khapra beetle was soon found also in other California counties, and that a study of these infestations showed this insect to have been present in the State as early as 1946, although it was not recognized until seven years later. Padget (1954) reported that the khapra beetle was first recognized in Arizona in December, 1953. The following record is believed to be the earliest yet reported of the occurrence of the khapra beetle in Arizona.

On April 15, 1956, a sealed pint jar containing insect-infested barley was discovered in a storeroom at the Tempe, Ariz., U.S.D.A. Laboratory. The data on the label showed that the material was collected March 16, 1953, from an infested grain bin in Phoenix, Ariz. A commercial pest control operator had brought the jar of infested grain to the laboratory where specimens from it were tentatively identified as belonging to a dermestid species.

The day following its discovery, this jar was taken to the Khapra Beetle Laboratory of Agricultural Marketing Service at Mesa, Arizona, where it was opened. An examination revealed living adults and larvae of the khapra beetle. The insects had apparently lived and multiplied in the sealed jar for three years and one month. Specimens were identified as *Trogoderma granarium* Everts by W. H. Anderson of Entomology Research Branch.

Literature Cited

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1954. Proceedings Pacific Coast Entomological Society. Pan-Pacific Ent. 30(1):89–90.

Armitage, H. M.
1953. 34th Annual Report. California Dept. Agr. Bull. 42(4):202–203.
1954. Current insect notes. California Dept. Agr. Bull. 43(1):41–42.

Padget, L. J.
1954. Status of the khapra beetle in the western states. Cooperative Economic Insect Report. 4(25):557–562.

[1] Arizona Agricultural Experiment Station Technical Paper No. 399.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

D. D. Jensen	W. W. Middlekauff	D. P. Furman
Vice-President	*President*	*Secretary*

Proceedings

Two Hundred and Fifty-second Meeting

The two hundred and fifty-second meeting of the Pacific Coast Entomological Society was held at 2:10 p.m. on Saturday, March 2, 1957, in the Morrison Auditorium of the California Academy of Sciences, San Francisco. President W. W. Middlekauff presided at the meeting. The following members were present: D. D. Jensen, D. D. Linsdale, J. A. Powell, L. R. Gillogly, J. H. Freitag, R. L. Doutt, J. W. Tilden, W. D. Murray, A. Ross, P. F. Torchio, K. S. Hagen, M. B. Gershenson, O. W. Graf, Jr., D. MacNeill, H. B. Leech, W. C. Day, R. L. Usinger, P. D. Ashlock, J. L. Herring, A. E. Michelbacher, E. G. Linsley, E. O. Essig, S. W. Hitchcock, P. D. Hurd, Jr., J. A. Chemsak, W. A. Russell, F. E. Skinner, L. M. Henry, E. S. Ross, K. F. Innes, W. H. Lange, D. P. Furman, J. W. Green, W. W. Middlekauff and R. C. Miller. Visitors were Mrs. J. A. Powell, D. W. Tuff, R. Schonert, Mrs. W. C. Day, Virginia Ashlock, Kate Herring, Mrs. Lorin R. Gillogly, J. G. Gillogly, A. Gillogly, J. W. Chapman, W. E. Ferguson, D. Giuliani, F. R. Brace, T. H. Lauret, Kay Furman, Grace MacNeill, B. J. Adelson.

The minutes of the meeting held December 15, 1956 were read and approved.

The President selected the Committee to decide on the date and arrange for the meeting place for the annual field trip: J. W. MacSwain, chairman, E. S. Ross and R. M. Bohart.

The President read the following report of the Book Review Policy Committee:

"Report of a Committee to Establish a Book Review Policy for the Pan-Pacific Entomologist"

The committee, named below, met on November 1, 1956 and drew up the following recommendations:

1. The Editor will be directly responsible in all matters pertaining to the review or notice of new books and other important works. Such authority may be delegated by him to a person serving as book review editor.
2. Books will not be reviewed or noticed simply because they have been received for such purpose from a publisher. Prime consideration will be given to the appropriateness of such reviews or notices appearing in the journal. Thus, most works treating the applied phases of entomology, and certain types of popularizations, will not ordinarily receive attention. Neither will titles appearing in entomological periodicals unless they were published as separate works.
3. Books suitable for review or notice will be placed in two categories:
   (a) Books or works of special significance worthy of *critical review* by a qualified reviewer.

(b) Works of lesser importance, or routine in character, which merely warrant a notice or short descriptive comment.

4. Works in the first category will be reviewed by a person designated by the Editor or Book Review Editor.
Ownership of such books may be assumed by the reviewer upon submission of a review acceptable to the Editor.
In the absence of a specially qualified outside reviewer, it is recommended that books be reviewed by persons willing to donate the books to the Society's library which is incorporated in that of the California Academy of Sciences.
5. Works in the second category, above, will be reported upon by a staff member of the Academy and thus automatically become available to the Society as a whole in the above library.
6. Reviews and notices will not be confined merely to books received for review. As a means of increasing the usefulness of the journal, every effort should be made to provide a comprehensive coverage, at least in list form, of new works significant to the various basic fields of entomology. If desired, review copies may be solicited for this purpose from publishers.

E. G. Linsley
R. L. Usinger
E. S. Ross

The following named individuals were nominated and unanimously elected to full membership in the Society: Ibrahim K. Kaddou, T. S. Acker, William E. Ferguson, Donald W. Tuff, Richard K. Eppley, Carole J. Worthington, Robert L. Langston, Dr. Gordon L. Bender.

In response to the call for Notes and Exhibits, Dr. J. W. Tilden displayed a box of empidid flies, or balloon flies, which he had collected in Mitchell Canyon, Mount Diablo, Contra Costa County, California. The balloons produced by these flies were more fragile and contained a larger insect than those made by flies of the genus *Empimorpha* which Dr. Kessel had collected in Marin County. The flies from Mitchell Canyon seemed closer to the genus *Empis*.

Dr. E. S. Ross presented a color motion picture on the alkali bee *Nomia melanderi*. He prefaced the showing with remarks on techniques involved in taking the pictures.

Dr. R. L. Usinger described the activities of the Royal Entomological Society and the South London Entomological and Natural History Society as illustrative of a wholly professional group and of a mixed professional and amateur group respectively in England. The former is comprised of a relatively small group of professionals meeting under formal circumstances. They have an excellent, large library as a major asset. The mixed professional and amateur group has numerous, well attended meetings, numerous exhibits, a large membership and numerous field trips. They also have a library, of more modest proportions. The interests of the group are largely in non-professional aspects.

Frank Skinner led the discussion which followed in formulating future

policies with respect to activities of the Pacific Coast Entomological Society.

The discussion developed the following ideas:

1. The notes and exhibits section of the meetings should be maintained and even expanded.
2. Meetings could well include:
   (a) a 5-minute report on technique
   (b) a 5- to 10- minute travel report with slides
   (c) a 5-minute historical account of entomological interest
   (d) a major speaker to take 20 to 30 minutes
   (e) occasional outstanding addresses to supplant all of above.
3. One meeting a year may be scheduled at one of the following institutions: University of California, Davis; Stanford University; San Jose State College; University of California, Berkeley.
4. Society to develop a sustaining interest in a field project such as the insect fauna of the salt marshes of the bay area. Reports to be made at regular Society meetings.
5. Newspaper announcements of Society meetings.

Frank Skinner stated that he plans to poll the opinion of the membership on the above items and also to include the question of Friday night vs. Saturday afternoon meetings.

Kenneth Hagen presented a motion that the individual showing the greatest entomological interest as exhibited at the Annual Science Fair be given a one year membership in the Society with a free subscription to the Pan-Pacific Entomologist for one year. The move was seconded.

E. S. Ross proposed the wording be amended to replace the subscription with the gift of a book of entomological interest.

The motion in amended form was carried unanimously.

A motion was introduced by R. C. Miller that the President appoint a committee with authority to act on the above award motion since the next Annual Science Fair is scheduled for the near future. The motion was seconded and carried unanimously.

The President adjourned the meeting after reminding the membership of the "coffee social" to follow immediately in the Entomology Museum.

—Deane P. Furman, *Secretary*.

Two Hundred and Fifty-third Meeting

The two hundred and fifty-third meeting of the Pacific Coast Entomological Society was held at 7:45 p.m. on Friday, April 12, 1957, in the Student Room of the California Academy of Sciences, San Francisco. President W. W. Middlekauff presided at the meeting. The following members were present: W. W. Middlekauff, E. L. Kessel, D. D. Jensen, D. P. Furman, D. D. Linsdale, V. Stombler, J. G. Edwards, D. J. Burdick, C. J. Worthington, R. K. Eppley, R. L. Doutt, T. S. Acker, E. S. Ross, J. A. Powell, L. R. Gillogly, W. A. Doolin, A. E. Michelbacher, E. O. Essig, T. A. Briggs, S. W. Hitchcock, J. A. Chemsak, O. W. Graf Jr., Brad Perry, H. B. Leech, F. E. Skinner. Visitors were C. J. De Mars, Katherine Furman, D. W. Price,

Lucinda Doutt, Mrs. L. R. Gillogly, Marie Essig, Martha Michelbacher, R. Schonert, D. H. Groves, S. Murray Sager, Minos E. Tzanakakis, J. O. Romke, Fred D. Bennett, Alden D. Hiaddey, J. J. Gillogly, A. R. Gillogly, Wm. J. Arnold, Phyllis Middlekauff, Mrs. D. W. Tuff, Susan Tuttle.

The minutes of the meeting held March 2, 1957, were read and approved.

President Middlekauff introduced Brad Perry, a ninth grade student from Hogan Junior High School, Vallejo, as the recipient of a year's honorary membership in the Society and an entomological book of his choice, as the award for the best entomological exhibit at the Fourth Annual Bay Area Science Fair. Richard M. Brown, a ninth grade student at Mount Diablo High School, Concord, and Fulton L. Saier, an eighth grade student at Jordan Junior High School, Palo Alto, received honorable mention for their fine collections.

The President stated that the response to the questionnaire polling the Society membership opinions on future policies and activities has been good, but that the data have not yet been compiled.

Dr. Jensen nominated for membership in the Society Mr. C. J. De Mars and Mr. D. H. Groves currently at the University of California. They were unanimously elected.

Dr. E. S. Ross stated that the annual field trip of the Society would probably be held on May 12 at Russelman Park.

In response to the President's call for notes and exhibits, Dr. R. L. Doutt exhibited two species of parasitic wasps attacking the Mediterranean flour moth: *Idechthis canescius* (Grav.) and *Habrobracon juglandis (=Bracon hebetor)*.

Jerry A. Powell exhibited a series of tachinid flies of the genus *Achaetoneura*, of interest because there were 32 specimens reared from a single cocoon of *Antheracea (Telea) polyphemus* Cramer. The moth cocoon was collected in February near Pittsburg, Contra Costa County, California, on willow. In addition, a second series of ten specimens of the fly were shown from another cocoon, in which the size of the individuals was markedly larger, presumably a function of the numbers of larvae parasitizing one moth pupa.

Mr. H. B. Leech exhibited a book entiled "Coleopteros do Brasil" by Jacintho Guérin in 1953; 356 pages plus 41 plates.

Mr. Lorin Gillogly exhibited the aphid, *Kakimia muesebecki* Knowlton and Allen, taken on flowering currants in a Watsonville nursery. According to L. Blanc, who identified the aphid, it is rather rare. It was described from *Ribes* at Redwood Canyon, California in 1939.

Mr. Gillogly also exhibited a pair of adult nitidulid beetles with larvae identified as *Epuraea monogama* Crotch. These were collected April 7, 1957 in a *Polyporus volvatus* fungus near Felton in Santa Cruz County. The fungi occur on dead coniferous logs or standing trunks.

In a notation on phengodid larvae and their food habits, Mr. Gillogly stated that in 1942 in Elysian Park, Los Angeles, California, he found several large larviform phengodids and phengodid larvae feeding upon snails which

they had killed. They were found in the Roman white snail *Otala lactea,* but not in *Helia asparta.*

Dr. Furman exhibited a small clubionid spider, *Cheiracanthium inclusum* Hentz, similar to one identified by Dr. W. J. Gertsch of the American Museum of Natural History. The particular interest of the exhibit was that this species has now been incriminated as responsible for painful bite effects in man in California. Details are to be published elsewhere.

Mrs. L. R. Gillogly exhibited a common California weed, *Epilobium paniculatum* Nutt., which has been found to be a food plant of the larvae of the emerald sphinx moth, *Arctonotus lucidus* Boisduval. Although the moth appears to be limited to California, it is statewide in distribution. It is not often seen in collections.

Dr. J. Gordon Edwards showed two excellent color slides of *Gryllob-latta barberi* Caudell.

Dr. E. S. Ross showed several interesting color slides, including close-ups of an albino frog found locally by Mr. Bander. A new genus and species of Enicocephalidae was pictured. Numerous slides of insects and a large jungle toad from South America were shown.

Dr. Ross described his plans for an African insect collecting and photography trip. The party will consist of Dr. and Mrs. Ross and Robert E. Leech. At present he is equipping a 1½-ton truck for the trip. He plans to leave on May 20th for New Orleans, thence to depart by freighter for Africa. The party will debark at Metadi, the port for Leopoldville and thence travel around the southern end of the continent and up the east coast.

Professor E. O. Essig commented on the very interesting fauna characteristic of Madagascar. It is not like that of adjacent Africa. He stated that he has two new genera and species of aphids from Madagascar which differ from any other aphids seen in possessing very long spines extending from the sides and back.

Dr. R. L. Doutt narrated a color motion picture showing the feeding, oviposition and other habits of parasitic and predaceous insects and mites. The outstanding close-up photography was by Ken Middleham of Riverside, California. The film was edited by Dr. Charles A. Fleschner.

The meeting was adjourned at 8:35 p.m.—DEANE P. FURMAN, *Secretary.*

Two Hundred and Fifty-fourth Meeting

The annual field meeting of the Pacific Coast Entomological Society was held at Russelman Park, Contra Costa County, May 5, 1957. The following members were present: E. O. Essig, E. S. Ross, H. Ruckes, H. B. Leech, John MacSwain, Jane MacSwain, D. P. Furman, E. G. Linsley, W. H. Nutting, W. Russell, J. A. Powell, F. E. Skinner, J. E. Swift, O. W. Graf Jr., P. D. Hurd, Brad Perry, A. E. Michelbacher, J. A. Chemsak, J. L. Herring, P. D. Ashlock, Paul Opler, W. Ferguson. Vistiors present were as follows: Mrs. E. O. Essig, Mrs. E. S. Ross and family, Mrs. H. Ruckes and family, Mrs. W. H. Nutting and family, Elsa Russell, Fran Powell, Marge Swift, Mrs. O. W. Graf and family, Grace and Kathy Hurd, Sue Tuttle, Bert and

Libby Adelson, Tom Leech, Frances Leech, Juanita Linsley, Kay Furman and family, Dr. and Mrs. R. W. Furman, Derham Giuliani, John and Lois Bogonono, Mary and Billy Leech, Jean, Roger, David and Susan Skinner, Stephanie, Robin and Rickie Ferguson, R. F. Smith and family, F. Bruce, Mr. and Mrs. H. Vannoy Davis, Celeste Green, Phil Bonhag and family, Mr. and Mrs. C. B. Perry, R. Howsmon, Kate Herring, Martha Michelbacher, R. E. Leech.

Once again the Society enjoyed a perfect day for the field meeting. Swishing collecting nets and clicking cameras were evident in almost equal numbers, reflecting an increasing interest in the pictorial, as well as actual, collection of insects in their natural habitats. Swimming, baseball and visiting rounded out a festive day.—DEANE P. FURMAN, *Secretary*.

Two Hundred and Fifty-fifth Meeting

The two hundred and fifty-fifth meeting of the Pacific Coast Entomological Society was held at 7:45 p.m. on Friday, October 11, 1957, in the Morrison Auditorium, California Academy of Sciences, San Francisco. Vice-President D. D. Jensen presided at the meeting. The following members were present: H. B. Leech, J. E. Swift, G. F. Ferris, L. M. Henry, P. H. Arnaud Jr., F. E. Skinner, E. O. Essig, A. E. Michelbacher, E. L. Kessel, J. A. Powell, T. S. Acker, E. G. Linsley, P. D. Hurd Jr., D. D. Linsdale, J. A. Chemsak, W. A. Doolin, D. MacNeill, R. L. Langston, D. Burdick, A. Ross, P. F. Torchio, C. J. Worthington, A. E. Pritchard, D. M. Maddox, D. D. Jensen, D. P. Furman. Visitors were Mike Kenny, G. J. Crowley, D. Breedlove, B. Barichievich, Mrs. J. A. Powell, Mr. and Mrs. E. E. Lindquist, Mrs. D. P. Furman, Mrs. E. G. Linsley, Mrs. Grace Hurd, Mrs. B. J. Adelson, Nancy Rutledge, Mrs. J. M. Burns, Dolores Damissio, Marie Moor, Patricia Heaton, Stennett Heaton, B. J. Adelson, S. G. Smith.

The minutes of the meetings held April 12 and May 5, 1957 were read and approved.

The following nominees for membership in the Society were unanimously elected: Dr. Frank A. Cole, Paul A. Opler, Thompson C. Lawrence, Evert E. Lindquist, Dr. Ernest S. Booth, Jack Hall, Clarence S. Davis, Mrs. Ruth Whitney, Michael Kenny, Gerald Crowley, Dennis Breedlove, Bruce Barichievich.

Dr. Jensen appointed the following committee to select nominees for officers of the Society for 1958: A. E. Michelbacher, Chairman; H. B. Leech, Laura Henry.

Dr. Jensen introduced as the speaker of the evening, Dr. S. G. Smith, Head, Section of Cytology and Genetics, Forest Insect Laboratory, Sault Sainte Marie, Canada. The title of the address was "Cyto-taxonomy of Insects."

Following a short discussion of Dr. Smith's address, notes and exhibits were presented.

Don MacNeill introduced Mr. Stennet Heaton who exhibited some interesting color slides demonstrating the versatility of the Leitz Ultra Pac

compared with other means of taking photomicrographs at medium to high magnifications.

John Chemsak showed a few slides representing areas visited in Chiapas, Mexico, where he collected insects and amber last summer.

Dr. Kessel played part of a tape recording made in 1952 of a conversation with our former colleague Dr. E. C. Van Dyke.

Don Burdick exhibited a living mantispid and also color slides of the insects in characteristic postures.

H. B. Leech discussed briefly the current collecting trips of Gene Monroe and of Ed Ross in New Guinea and Africa respectively.

Dr. E. L. Kessel exhibited several hundred unmounted smoke flies *(Micronsania)* which he had strained out of the smoke of a backyard smudge at Spenard, Alaska, during his recent trip. Although unreported from Alaska and Yukon territory, he captured microsanias also at Girdwood and at Gardiner Creek in Alaska and at several of the official camp grounds along the Alaska Highway in the Yukon—in fact wherever he built a fire, these tiny dipterans congregated in the smoke. The trip produced some 200 other flies of the family Platypezidae none of which were previously reported from the Yukon and very few of which had been taken before in Alaska, British Columbia, and Alberta.

The meeting was adjourned to the "Coffee Social" at 9:20 p.m.—DEANE P. FURMAN, *Secretary.*

Two Hundred and Fifty-sixth Meeting

The two hundred and fifty-sixth meeting of the Pacific Coast Entomological Society was held at 2:00 p.m. on Saturday, December 7, 1957, in the Morrison Auditorium, California Academy of Sciences, San Francisco. President W. W. Middlekauff conducted the meeting. The following members were present: E. O. Essig, A. E. Michelbacher, D. Breedlove, T. Lawrence, S. W. Hitchcock, D. D. Jensen, M. Kenny, P. D. Hurd, W. E. Ferguson, K. S. Hagen, A. E. Pritchard, F. E. Skinner, H. E. Stark, D. G. Denning, E. Cott. W. A. Doolin, O. W. Graf Jr., C. J. Worthington, A. Ross, W. A. Russell, D. D. Linsdale, H. B. Leech, W. W. Middlekauff, D. P. Furman. Visitors were David Peterson, John Nickel, Michael Tomei, Marie Moor. Dennis Hyms, Nancy Rutledge, Dolores Damiano, Loretta Denning, James Denning.

The minutes of the meeting held October 11, 1957, were read and approved.

Lionel A. Stange, Louis A. Ruud, Kevin P. Shea and R. G. Dahl were elected to membership in the Society.

Mr. Frank Skinner, Chairman of the Program Committee, announced that 77 of the questionnaires sent to members had been returned. The majority favored the changed format of meetings now in operation. Other suggestions approved included newspaper announcements of meetings and the principle of holding one meeting a year at some outside institution.

Mr. H. B. Leech, Chairman of the Auditing Committee, stated that the books of the Society are in order and are accepted as they stand.

Dr. Middlekauff exhibited a sample of privet hedge defoliated and debarked by grasshoppers.

Dr. Furman exhibited living larvae and an adult of *Hermetia illucens* (Linnaeus) which have been found breeding quite commonly in poultry manure of the San Joaquin Valley. Under favorable conditions larval populations form an almost solid mat of one to two inches in depth. Such populations work over added manure very rapidly. Laboratory experiments indicate that housefly larval development is inhibited or stopped short of the pupal stage in competition for food with the stratiomyids.

Dr. Michelbacher reported that the nominating committee proposed the following as officers of the Society for 1958: Dilworth D. Jensen, President; Richard L. Doutt, Vice-President; Deane P. Furman, Secretary; R. C. Miller, Treasurer. They were unanimously elected.

The chairmanship of the meeting was then turned over to President-elect Jensen who called on Dr. Middlekauff to give his presidential address entitled "Biology and Ecology of Several Species of California Rangeland Grasshoppers" which is published in this issue.

Following a discussion of the presidential address the meeting was adjourned.—DEANE P. FURMAN, *Secretary*.

HARZWANZEN OR "RESIN BUGS" IN THAILAND

Two species of Reduviid bugs, *Ectinoderus longimanus* Westwood and *Amulius malayus* Stal, were observed while on an excursion with the Entomology Section at the Ninth Pacific Science Congress in Bangkok. On November 23, 1957, the group stopped south of Bangkok at Bang Lamung and observed holes one foot or so in diameter cut in the trunks of large *Dipterocarpus alatus* trees. Pools of resin accumulate in these holes and the material is collected for use as a varnish and to caulk boats. Burning, which is illegal in Thailand, stimulates flow of resin and chars the wood around the hole.

This microhabitat attracts stingless bees, *Trigona (Tetragona) iridipennis* F. Smith (det. H. F. Schwarz), which were seen swarming in front of the holes and which collect the resin for their nests. Lying in wait for the bees at the edges of the pools of resin were the large (15–30 mm.) resin bugs mentioned above. Bugs of these genera have been reported previously by Roepke, W. (Miscellanea Zoologica Sumatrana, LXVIII, pp. 1–5, 1932) and Miller, N.C.E. (Proc. Royal Ent. Soc. London, A, 17:54–55, 1942) as living in cracks in the bark of *Agathis alba, Altingia excelsa,* and *Pinus merkusii,* and catching *Trigona* bees in Sumatra and Malaya. They reported that the bugs dip the front legs in sticky exudations to cover the tibiae and one segmented clawless tarsi. Long erect hairs on the tibiae serve to hold the fluid. The legs are held forward like those of a pseudoscorpion and are used to trap the bees.—R. L. USINGER, *University of California, Berkeley.*